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ABSTRACT

This paper details a computer managed program of instruction called Teaching Information Processing System (TIPS), as adapted to an introductory psychology course. TIPS encourages the instructor to formulate objectives for meaningful units of a course--objectives which should imply what changes in student behavior indicate mastery. Then multiple choice questions are written to assess student course mastery. The TIPS program uses each student's performance to generate a uniquely catered prescription detailing where performance is above, at, or below standard and what actions the student is advised to take. Early work developing the program is reviewed as well as student ratings of TIPS, comparison of TIPS and non-TIPS classes, selected samples of TIPS objectives, and quiz questions. Evidence is presented indicating that TIPS seems neither to help nor hinder the "below-C" students, but those less well off students are more satisfied with their education in a TIPS course. They drop the course with more precise reasons related to course content, and show a greater likelihood of re-enrolling in the course in a subsequent semester than students who withdraw from a non-TIPS section. (Author/RAA)

COMPUTER-MANAGED INSTRUCTION:

INDIVIDUALIZING INTRODUCTORY PSYCHOLOGY FOR 1,000 STUDENTS

by

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and

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Computer-managed instruction:

Individualizing introductory psychology for 1,000 students

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I introduce approximately 2,000 undergraduates a year to psychology at the University of Houston in a course that is offered in a large lecture format (to 5-600 students), but also via television to another 5-600 students. We have now implemented a computer-based testing system called the Teaching Information Processing System--or TIPS--in order to increase our "personal" contact with each student. Today I'd like to spin the story for you as to how we implemented the program, something about our observations as to its effectiveness, and what the students' response to it has been.

First, let me describe the Introduction to Psychology course for you. Over the past four years we have enrolled an average of 527 students per semester in our television section and an average of 489 per semester in our lecture section. The course is prerequisite to almost all other courses offered by the Department, and it is among a limited number of Social Sciences options in the curriculum of many of the University's colleges. In a typical Fall semester students will be drawn from all 11 colleges that include undergraduates. 12.5% have a declared major in Social Sciences (4.2% in psychology), 32.6% in Business Administration (the largest single source of students), 15.1% in Natural Sciences/Mathematics, 14.1% in Humanities/Fine Arts, and 25.7% from the remaining seven colleges. Of those students, a typical breakdown is 52.8% first-year students, 23.8% sophomores, 13.7% juniors and 9.7% seniors and others. Obviously, the backgrounds and perspectives of my students are quite diverse!

The lecture section meets twice a weeks for 75 minutes. Using a course outline (**Psymple Psych**, Kasschau, 1979) that is available to students, we give lectures and demonstrations, accompanied by perhaps 10 movies and approximately 1,200 slides. The television section, insofar as I know, is unique. Covering exactly the same material (the Psymple Psych book is used in both sections), the lecture/demonstration material is contained on 60 half-hour television tapes. These tapes are played in pairs, with each duo played for two days in a 48-seat room. The tapes are played 16 times during the two-day period according to a preannounced and published schedule. Students enroll for the course, but choose their own viewing hours--restricted only by the availability of seats in the television room. (As an intriguing aside, our attendance figures indicate that we teach about 2/3s of our students between 9 a.m. and 3 p.m. although the tapes--on various schedules--have been available some semesters as early as 8 a.m. and as late as 10 p.m.) A graduate student is always in attendance in the television room.

The tapes--after trying many varieties--are played back-to-back and followed by a 15-minute period of discussion. In addition, in response to a graduate student's suggestion, we now offer discussion periods at 10 a.m. and 1:15 p.m. five days a week with the students signing up for the section they wish to attend. This links each undergraduate with a specific teaching fellow and has a tangential benefit for TIPS to which I'll return later. Lecture students are informed of these voluntary discussion sections, but they are not required to attend. In fact, attendance is voluntary for all our sections. Data indicates that in lecture--after the early semester enthusiasms/compulsions settles down--we hold 80-85% attendance. In the television section that is slightly lower--hovering around 80%, but its slightly lower because 5-10% of the students repeat a viewing. So let's say attendance in the television section is in the mid-70s.

Aside from these differences, students are treated as similarly as possible: Each section is given three examinations during the semester, noncumulative and covering about a third of the total material in each exam. Students are also expected to do an

nde pendent project volunteer work, serving as an undergraduate research assistant, writing a terin paper or a book critique, developing an audio or video (slide) demonstration, or conducting a small research project of then own. In addition they have an array of options for exposing themselves to research as subjects, listening to and viewing televised interviews with nine scholars, and attending occasional lectures by visiting dignitaries--Jim McConnell spoke to the classes year before last, for instance. In short, our students are offered a diverse, complex exposure to the discipline.

GOALS

Our course content goals are four-fold: (1) To familiarize students with the important terms and definitions--the basic language of psychology. (2) To encourage students to learn about the basic research strategies used by psychologists, especially as they are applied in the different content areas of our discipline. (3) To provide the students with opportunities to see the points in their own life where the principles and findings of psychology can be applied and to expose them to procedures for making those applications. And ultimately, (4) we hope to convince our students that human and animal behavior is lawful, subject to analysis and study.

In terms of process goals for my course, we are hoping: (1) To challenge/encourage our students--starting where they are--to move them forward in understanding both themselves and psychology. (2) To play to the students strengths--both intellectually and personally. (Example: notice the variety of indpendent project options that are available to them). Finally, we hope (3) to personalize the course content and procedures to the largest extent possible. Fifteen-twenty nonoverlapping office hours are offered each week, coffee is for sale all the time the television room is operating, and I sit in at least twice (formally) and as many opportunities as I can make for myself to critique the teaching style of each of the graduate students.

Need for TIPS

The reasons underlying our decision to implement the TIPS system were four-fold:

(1) the size of the course itself. We have roughly 1,000 students a semester. (2) The limited nature of the available help: There are only eight teaching fellows and one of me. (3) We had data indicating that the teacher-student contact per office hour was approximately 0.4 per hour(1). I should remind you, of course, that the graduate students are available 12-14 hours per day in the television classroom--depending on the precise schedule of operation we choose. Finally, (4) the diverse nature of the students enrolling in our course--as we hinted to you earlier. So we implemented TIPS on a pilot basis in Spring 1977 and formally for all students in both sections in Fall 1977. We are now entering our third year of full-time operation with the system. And what is the nature of that system?

TIPS System

At its simplest, in order to implement a TIPS system you must tell your students what you wish them to learn, assist them in learning the material (by whatever means), and then assess whether they have mastered your/their material. Getting from that statement of policy to an implemented system involves perhaps two months' work, attendance at one two-day seminar, a computer of adequate capacity, and some luck.

In essence the major elements of the TIPS system are as follows. First, course objectives must be laid out. I have always had some reservations about "behavioral objectives", but one of the advantages of the large number of TIPS Quizzes the system allows is that instructor and student can reach a level of understanding as regards what is expected in terms of the stated objectives for a course. In the abstract some of the content objectives for my course seem fuzzy or unmeasurable, but as we gain experience with each other, students seem to grasp what is intended by the specified objectives.

Implicit in those objectives is one assumption that does not trouble me: If we are accomplishing something as educators, then it should show up as detectable changes in behavior, if we can pose a question that will be answerable once our course material has been mastered, but not otherwise. In short, I would maintain that education does have a

detectable, measurable impact on our students.

Second, having specified your objectives it is then necessary to go through your course material, objective by objective, and generate questions for which the student responses will indicate whether the student has mastered the concept. Here one's skill as a question-writer is pushed to the limit. In a moment I'll show your how/why.

Third comes the tricky part. If we view the computer program as simply an interface between you as teacher and your individual students, you must now ask yourself, "What would I tell this student to do or study if he/she got this question right? What would I want to tell him/her if it was missed?" The answer to your own question determines the nature of the next step.

The beauty of the TIPS program is that you can write "prescriptions" for your students in a staggering array of detail and sophistication, or very generally depending on time and inclination. For example, if you've given a 10-item quiz, you may be interested only in encouraging the best and brightest to consider doing an independent project and reading independently on their own. If so, you could instruct the computer to address such a message to those students scoring in the top 5 or 10 or 30% of the class on your quiz. You might instruct the middle block of students to continue as they are, perhaps spending a little more time on the reading and course activities. And, you might instruct those students in the bottom 5 or 15 or 30% (you decide!) to see you or to meet with a graduate assistant or visit the school's Reading Clinic. Which of these "prescriptions" is printed for each student can be determined on the basis of the percentile rank on a quiz or in terms of their absolute score on a quiz--so that if everyone got 5 or more of the 10 items correct, they'd all get the same message. This same logic can be applied to subsets of questions, or even to individual questions! Again, the only limit is your own ingenuity and available time.

As a review for you, my course is composed of ten content sections: Methods and Data, Developmental, Physiological, Sensory Processes, Learning/Memory, Language,

Motivation/Emotion, Individual Differences/Testing, Personality, and Social. In addition, each content area is divided into 30-minute lecture segments because of the nature of the television course. So, when we construct a TIPS quiz, we ask the TIPS program to analyze student performance for each subset of quiz questions that relate to one 30-minute segment of material--usually two questions. Thus, for each pair of questions we will generate either two or three prescriptions--assuming the student missed none, one, or two of the questions. As his/her performance deteriorates, the nature of the feedback becomes increasingly directed. . .even to the point of saying "If you missed Question 2, go back and read Pages 38-39 in Psychology and Life, and do activity #2 on Page A-16 of Psymple Psych."

In addition to prescriptions based on a student's performance on individual questions, you can also instruct the computer to analyze the students performance on the entire quiz either absolutely or relative to his/her standing in class. Finally, you can also relay messages to the entire class--of the upcoming appearance of Jim McConnell in the lecture section, of visiting dignitaries in the department, or anything else you wish to call to their attention--such as a Labor Day vacation, or your own absence from the classroom so as to give a paper in New York!

Finally, the program will store the information from each individual quiz--retaining up to 75 questions spread across 5 quizzes. Once we've finished Methods and Data, Developmental and Physiological, we have our first exam. Thus, after the computer has scored each student's third TIPS quiz we ask it to review the student's performance across all questions relative to the class' performance as a whole. For the top 10% we send a "warm fuzzy" that congratulates them on their performance thus far and suggests they relax and continue in their current form. For the middle 80% we encourage more studying, review of Psymple Psych, and re-reading the course text. For the bottom 10% we suggest an immediate appointment with. . .and the name of their discussion leader (of the weekly session for which they have signed up) is filled in. If a satisfactory plan of study is not

developed, if they meet with me unsatisfactorily (or are unable to schedule an appointment), we indicate their performance suggests they will have serious difficulties with the first exam and that they might wish to consider dropping the course, or delaying taking it for another semester.

In review, then, you first specify objectives--what are you trying to accomplish in your teaching? Then you write questions to assess student progress toward accomplishing your objectives. Finally you write prescriptions intended to guide students toward better mastery of your objectives if their quiz performance indicates they're having some difficulties. Give the quiz, score it, hand out the prescriptions, and then wait for the impact.

There is an additional strong value to this tool--not immediately obvious--and (unfortunately) not available to me in the television section. In addition to the prescription sheets given back to the students, the computer gives each teaching fellow a listing of his/her students performance broken down by name and performance on each individual question, as well as a frequency distribution of his/her students' choices across each of the response options for all questions. Additionally, as instructor, I get a similar table for the entire class, without names.

Thus, by watching the TIPS output I can monitor the teaching effectiveness of each of the teaching fellows and (more importantly) I can instantly identify any concept or group of concepts the students have not mastered. That means I can review material they've failed to master before moving on to new material based on a misunderstood principle or definition or concept! Thus TIPS makes the lecturing/teaching process self-correcting and responsive to student mastery of the subject matter.

STUDENT RESPONSE IN THE CLASSROOM

The system was originally developed 10-12 years ago by Allen C. Kelley at the University of Wisconsin, then teaching a large-enrollment introductory economics with problems and limits similar those I've described. My psychology course is divided into 10

content areas. In the television section these areas are presented in anywhere from 4 to 8 30-minute segments; the lecture course has a similar distribution. For each section of the course we have published in an Appendix in the Psymple Psych book a series of objectives--skills the student should gain upon learning the material. Typically, we have specified two objectives for each 30-minute lecture. As an example, in the "Basic concepts" portion of the METHODS AND DATA section the objectives are stated thus: "At the time of the TIPS Quiz (with 80% accuracy) you should be able to: (1) Identify proper and improper examples of an operational definition, and (2) Distinguish examples of independent, intervening, and dependent variables given verbal descriptions of such variables or graphed versions of functional relationships."

In order to assess the first objectie, for instance, on the first TIPS quiz students are asked the following multiple-choice question:

5) Which of the following is an operational definition?

1) speeding = traveling one mile in less than two minutes where the posted speed is 30 miles per hour

2) loving = a feeling of joy

3) smiling = occurs any time two good friends have not seen each other for a week

4) testing = thinking "one, two, three" every time you see a microphone

As we finish each section of course material, the TIPS quiz is available for two days in the television classroom. The 15-minute discussion period following the completion of a section of course material is utilized for administering the TIPS quiz in the television section; the first 10 minutes or so of the lecture section is similarly dedicated. However, students in both sections are allowed to take the quiz home if they prefer. In order not to delay card-punching and processing of the results, we have a posted, absolute deadline after which no TIPS quizzes will be accepted for scoring. Once the quiz has been completed, it is key-punched and entered with all students' data simultaneously. The single- or double-page printout is distributed during the night or

before opening the television classroom the following morning so that students have feedback as soon as possible after the closing time for submitting the quiz.

This Fall is the first time we've allowed the take-home option, so we have nothing yet to report on that feature. However, test security has been no problem for a very simple reason: no credit is given for TIPS Quiz performance. When the system is introduced, it is presented to the student as a tool with which they can assess--in a no-threat situation--how well they are progressing toward mastery of material the course instructor deems important. They are informed the quizzes will be available, that the questions will be similar to (but not identical with) questions to be asked on regular examinations, so the test-taking experience certainly will help them. General details about the nature of the prescriptions generated by the computer are also relayed, but not significant amounts of information about the working details of the program.

Our experience in terms of student cooperation with the ground rules of the TIPS system has been very positive. There is no personal benefit to be gained by cheating, and we've found absolutely no evidence of cheating as the TIPS quizzes are being taken in the classroom.

Student participation in the TIPS quiz system declines during the semester, as one might expect. Preliminary analysis of student grades as a function of final course grade for those actually using TIPS suggests that students earning an A-grade for the course are performing 8-10% better than students earning A's who took comparable course examinations during the year preceding implementation of TIPS. For B students, the increased exam performance is 3-5% higher. For C students as a group, as well as those earning a D or F in the course, participating in TIPS does not seem to influence their exam performance in the course.

One unique aspect of the University of Houston bears on the apparent drop-out rate from TIPS. In a 14-week semester, our undergraduates are able to drop a course until almost 11 weeks into the semester(!). As a result, doubtless, some students have intel-

lectually "dropped" the course well before the University (and I as instructor) get formal word of the withdrawal. In a typical semester, starting with 500 students, we will assign final grades (other than I or W) to only about 60% of them. Whereas 88-90% of the 500 students at the start of the semester will take a TIPS quiz, only 50-52% of the remaining 300 will participate in the last group of TIPS Quizzes. It is difficult to pin-down the reason for this, but several have occurred to us. First, in past years it has been possible for students to avoid taking the final exam under certain circumstances. Their "incentive" to continue TIPS is likely to be reduced. Second, our initial strategy in developing the original TIPS quizzes was to make them harder than the actual examinations on which the students would be graded. We were concerned that since the TIPS quizzes followed right on the heels of completing a section of material, it might be the case that student performance would top-out, causing the TIPS system prescriptions to create undue optimism on the part of the students. To prevent this we seem to have over-reacted by making the TIPS Quiz questions too difficult. Class averages on each quiz--ranging from 8 to 15 questions in length regularly fall between 48-55%! Clearly it has not been a public-relations, Trendex success to give/take a TIPS quiz! Again, this has doubtless lessened participation.

Overall, at this point we're two years into the TIPS testing program. Student response has been very positive and the data we've collected seems to confirm our impression that the TIPS quizzes are having their intended effect: Helping our students master the course content and principles of introductory psychology.