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ABSTRACT

This paper describes the personalized system of instruction (PSI), a teaching method based on a high student involvement in the learning process, immediate feedback, mastery learning, and careful planning and instructional design of the course content. With PSI, students proceed through the course at their own pace and are required to demonstrate mastery of each component before proceeding to the next; teaching materials are largely text-based; proctors provide tutorial support; and lectures and demonstrations are intended to motivate students rather than deliver course content. PSI is deemed especially useful in courses where content is primarily skill development or cognitive information and for courses with large enrollments and limited resources. This paper describes use of the PSI method in a computing course at Texas Tech University. Reported difficulties include: procrastination; difficulty in recruiting proctors; cheating on tests; organizing the course so that the modules are well-articulated and based on a logical hierarchy; complaints that learning small isolated bits of information inhibited synthesis of information; appropriateness of the PSI model for the course; a greater-than-normal instructor time commitment; changed teaching role; keeping module materials current; and varied student learning styles. (Contains 11 references.) (CH)

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PSI Revisited:

Designing College Courses Using the

Personalized System of Instruction (PSI) Model

by

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Most innovations in education usually have short histories. Many are developed for unique situations, are too expensive to be practical, or are keyed to technologies, which quickly become obsolete. The Personalized System of Instruction (PSI) however, is an exception to the rule and has commanded attention for three decades. The PSI approach is based on the elements of high student involvement in the learning process, immediate feedback, mastery learning, and careful planning and instructional design of the course content by the instructor. For courses where the content is primarily skill development or cognitive information, PSI is a proven winner and is especially helpful for courses with large enrollments which are offered by institutions with limited resources.

Basics of the PSI Model

The PSI model was first introduced by Keller and Sherman during the 1960s as a form of programmed instruction that employed a highly structured, student-centered approach to course design (Hambleton 1998). The distinguishing features of a course based upon the PSI approach to course design were as follows (Keller and Sherman 1974):

1. students proceeded through the course at their own pace;

2. students were required to demonstrate mastery of each component of the course before proceeding to the next, although summative assessment was still provided by means of a final examination;
3. the teaching materials and other communications between teachers and students were largely text based;
4. 'proctors' provided tutorial support and assessed the achievement of students on individual components of the course; and
5. Lectures and demonstrations were intended to motivate students rather than to deliver core course content.

The PSI model has been used with a wide variety of academic levels, institutions and disciplines. Most often the model has been applied at the college level but PSI courses also exist in secondary schools and in adult and continuing education. The PSI model has been widely applied to university courses with large enrollments. The limitations of large lecture-based courses are well known (Callahan 1990), and one would expect that improvements in learning and motivation would occur in a more student centered approach. Also, economic necessity has forced administrators to look for cost effective ways of dealing effectively with large numbers of students. One example of a long established PSI course is an introductory computer applications course (EDIT 2318) offered by Texas Tech University where a PSI model has been employed since 1985. The course enrolls approximately 1,500 students per year. Student achievement and student evaluations have remained consistently high for the course throughout the period (Price, 1995).

There is a substantial body of literature spanning a thirty year period that attests to the broad effectiveness of PSI courses in terms of both student mastery of course content and student course evaluations (Kulik, et. al 1979; Jacobs 1983; Kulik and Kulik 1989; Gibbs, 1992, Hambleton and Foster 1998). Some of the generalizations of this research are as follows:

Mastery Orientation. Of all PSI features, the mastery orientation seems the most important for academic performance. Studies have shown that when the mastery-over-small-steps requirement is held constant, final exam performance remains constantly high even when mastery criterion is set at a high level (Hambleton 1998). In Texas Tech's EDIT 2318 course, there are a series of 10 module tests. Each is composed of an objective test and a set of computer application exercises, which are designed to indicate mastery of important facts and concepts as well as competence in computer skills. A grade of 80% is required to show mastery. However, students may attempt each module test up to 3 times.

Self-Pacing. The intent of self-pacing is to assure that those who are better prepared are never held back and may complete course requirements early. Other students are able to proceed at a pace, which suits their abilities or personal schedule. Self-pacing does not seem to be critically related to academic performance. However, it is a factor in producing favorable student attitudes. Some students prefer the option to finish early

while others take advantage of provisions to take breaks from study when personal, academic, or work schedules demand increased attention.

Modules. An instructional module, or lesson, should consist of three basic parts: the presentation of original material, assessment, and feedback/remediation. The organization and format of modules is important since this is usually the only communication between the student and instructor. The procedures of a PSI course are usually novel to the student and are sometimes complex. Students are likely to become confused and anxious unless special efforts are made to anticipate these conditions. Clear, precise, and well-organized modules are essential to a successful PSI course. At Tech, each module consists of a reading assignment, hands-on computer application exercises, and a test. Specific objectives and directions are provided for each module.

Lectures. Since the role of lectures in PSI courses is minimized, they are usually given infrequently and attendance is optional in some courses. Their main purpose is to motivate students and to develop rapport between instructors and students. In some PSI courses, lectures have been removed entirely without adverse effects.

Proctors. The use of proctors and emphasis on personal interaction distinguishes PSI from most other forms of individualized instruction. In PSI courses, proctors make frequent testing and immediate feedback possible and are in the position to encourage and interact with students individually. Proctors also function as tutors by clarifying objectives and explaining difficult concepts. Research has shown that field independent

students generally achieve better academic success in PSI courses but that the use of proctors contributes more to the success of field dependent students when proctoring is a major course component (Jacobs 1983).

A Model for PSI Courses

The PSI course syllabus will look very similar to that of a conventional course and will include a course description, course objectives, a list of texts and any other required materials, course procedures and policies, and a list of assignments and grading procedures. Since the course is self-paced, there will be no rigid course schedule although a series of deadlines may be included.

The computing course modules at Tech are divided into the following sections: Introduction, Module Objectives, How to Proceed, Discussion, Computer Applications Assignment, Review Questions, and a Module Test, which are reviewed here. Modules are printed and combined into a course study guide which students obtain after course enrollment.

Introduction. The introduction presents an overview of the module in about a half page. It includes a statement of the importance of the lesson, a brief overview of the material and activities to be covered in the lesson, and sometimes thought provoking questions which are intended to focus the student's attention. For example, a module on electronic spreadsheets might include the following questions: "Have you ever wished that you

could plan a personal budget that would show you exactly how much net income you would receive from your job?" Or "Would you like to be able to easily see exactly how much of an effect a raise in salary or a new expense would have on your budget?"

Lesson Objectives. These are measurable statements of learning outcomes that clearly state what the student is expected to know or be able to do after completing the module. For the electronic spreadsheet module sample, we might include the following objective: "After completing this module, you will be able to construct a personal budget using an electronic spreadsheet program which will include formulas for calculating net income from gross income and will include your own personal expenses." It is important that objectives be comprehensive enough to include all expected learning outcomes for the module and they should be clearly and unambiguously stated.

How to Proceed. This section is a step-by-step listing of what the student is to do in order to complete the module. Here's an example:

1. Read the module introduction and objectives.
2. Read Chapter 5 of the textbook and the discussion material included in this module. Pay careful attention to the terms introduced and the procedures for constructing a personal budget.
3. Go to the computer center and complete the applications assignment included in this module.
4. Answer the review questions at the end of this module.

5. Staple a cover sheet to your completed applications assignment and review questions and turn them in to your instructor.
6. Take the Module 5 test in the Computer Testing Center.
7. Proceed on to Module 6.

These instructions are intended to specify precisely what the student is expected to do and the order in which the steps are to be completed. The intent is to leave little room for possible misunderstandings.

Discussion. This section might be thought of as a substitute for the class lectures. The purpose here is to supplement the text, not to repeat it. Important concepts and principles can be pointed out and explained. Important information that is not included in the text can be added. Points that the student may find confusing can be explained and the importance and application of the module material can be stated in order to motivate the student.

Computer Applications Assignment. In this section, one or more specific hands-on computer assignments are given. In the spreadsheet module, one assignment is for the student to construct a personal budget using an electronic spreadsheet program. Specific instructions are given including examples, diagrams, and computer screen examples as appropriate. The student proctors are available in the computer center to answer questions and assist with minor technical problems as students complete the assignments.

The assignment section also specifies exactly what items the student is to hand in to the instructor.

Review Questions. This section includes a set of self-graded multiple choice and short answer questions, which are designed to measure the student's mastery of the module objectives. They are similar to but not identical to the questions contained on the module test.

Module Test. The multiple choice item format is the most commonly used testing format in PSI courses. There are two basic reasons for this. First, tests must be fairly brief so that students can complete a series of tests during the term. Second, tests must be scored objectively to remove any possibility of ambiguous grading and so that students receive immediate feedback. A typical module might contain 10 to 20 multiple-choice questions. At Tech, we use computer testing. Each module test is constructed by the computer from a pool of questions and is administered via computer. Each test takes only about 10 minutes for most student to complete. Tests are graded immediately and feedback is provided to the student after each test. The feedback tells the student whether or not he or she made a high enough score to master the module (80%) and provides hints on how the student should study to improve his or her score. Students are allowed to take each module test 3 times. The testing program also stores student grades and produces reports for course instructors. In other PSI courses, tests include problem solving, demonstration of skills, or short answer items. Test items must be constructed carefully to ensure that they accurately measure the module objectives and are unambiguously stated.

Problems Associated with PSI

Some of the difficulties associated with PSI courses are as follows:

Procrastination. Researchers have reported high numbers of students who do not complete PSI courses. This is linked to the self-pacing feature of PSI. Many students seem unable to organize their time efficiently, perhaps because of having experienced many years of schooling where the learning pace has been provided externally. One means of reducing procrastination is to introduce some instructor pacing into the course. This is a lesson which we learned early at Texas Tech. Soon after adopting a PSI model, we added a series deadlines for module completion. Students may complete the course as quickly as they are able to but are not allowed to fall too far behind.

Obtaining Proctors. Peer proctors may be recruited from a number of different sources. Most PSI courses use proctors who have been students in the course previously. Another option is to employ student workers who have been trained in the course content. Proctors can be also be recruited from the class itself if some students have a good understanding of the course content prior to enrollment. At Texas Tech, we use a somewhat different approach by recruiting proctors from students enrolled in the university honors program who are taking the course as a required general education requirement. These are students who have high academic status. They tend to be highly motivated and reliable. To make service as a proctor appealing and worthwhile for the

student, we supplement the proctors training with enrichment experiences, which are not available to regular students. Proctors receive honors credit for the course, which helps them achieve a goal of graduating with from the university with honors. Regardless of the source of proctors, their training and motivation is one of the most critical elements that can determine the success or failure of a PSI course.

Tests. Cheating is a potential problem in testing. To help ensure test security at Tech, we require that students present a photo ID in order to take a test. We assign students to computer workstations at random and the testing center is monitored by an instructor as well as video cameras at all testing sessions.

Module Size and Organization. One of the first steps in preparing a PSI course involves breaking the content into a series of lessons or modules. Organized the course into a series of well-articulated modules based on a logical hierarchy, subject matter organization, or task analysis is essential. Research shows that students learn more when content is broken down into a series of small, more frequent, modules rather than fewer and smaller, lower frequency, modules (Gagne and Biggs 1979). A typical PSI course has from 10 to 30 modules.

Synthesis. One of the most common criticisms of PSI courses from students as well as instructors is that learning small isolated bits of information in the modules inhibits the synthesis of information. However, some studies have shown that this may be a felt problem rather than real. PSI students tend to better on the final exam, which requires

integration of course material, than students in conventional courses (Corey and McMichael 1974). Some developers include a review or synthesis module near the end of the course or a series of small review or synthesis modules throughout the course.

Appropriateness of PSI. The PSI format is best suited for courses involving skills or cognitive information. For courses which require a good deal of group interaction, student-determined goal setting, or provide for unique experiences for the student, the PSI model is probably not appropriate.

Instructor Time Commitment. Initial instructor course preparation time is typically much greater for PSI courses than for a conventional course. Course management, training proctors, and providing for individual meetings with students also present demands on the instructor's time. At Tech, we use a team approach. EDIT 2318 enrolls approximately 650 students each Fall and Spring semester. A faculty member serves as course coordinator and receives credit for 1 course on the usual teaching load for doing so. The faculty member supervises and coordinates the course and trains and supervises proctors. Two teaching assistants serve as instructors for 4 sections of approximately 150-160 students each, and honors students serve as proctors. Instructors grade assignments, answer questions, supervise testing, provide a series of optional lecture/demonstrations, and counsel students. Another teaching assistant supervises the computer and testing centers on weekends and helps grade assignments.

Changed Teaching Role. In the PSI model, the role of the teacher is dramatically changed from that of an imparter of information to that of an instructional designer and manager. Many faculty members do not relish such a role change. The teacher may cease to be the center of attention in the classroom or the perceived source of information in the course.

Staying Current. Some subjects require more frequent updating than others. Since Tech's course deals with technology, it is important that we work to stay current so time must be planned or course renewal. At Tech, the course study guide is revised and updated annually each summer. This is a full time effort for about 6 weeks and is usually done by a graduate assistant working under the supervision of the faculty course coordinator. Discussion material and assignments are changed as appropriate and the changes needed for new versions of software are incorporated into the instructions. The computer-testing program which administers module tests was written early in our adoption of the PSI model and the test bank is updated annually after the each new version of the study guide is produced.

Student Learning Style. While most studies have shown that PSI students generally score higher than students in traditionally taught courses, no one instructional method has been shown to be optimal for all students. Highly motivated students who have an internal locus of control and are field-independent do best in PSI courses (Hambelton,1998). Students who have difficulty organizing their time, planning, working independently, or who lack motivation are less likely to be successful in a PSI

course. Our experience at Tech is that most students perform well and prefer the PSI model of instruction. Most students take the course to meet a university general education requirement for computer competency. Other courses, which offer a more conventional course structure, are also available to meet this requirement, and students may select the course that they feel most comfortable with. However, the PSI course continues to fill to capacity each semester.

Other Applications of PSI

I have dealt here primarily with campus-based instruction. However, it is worth noting that PSI can be successful employed in other forms of instruction. Distance education lends itself well to the PSI framework. In an earlier article, I reviewed the use of PSI for the design of courses designed for the world wide web (Price, 1999). PSI has also been widely used in the design of correspondence courses and other forms of self study, although some modifications to the traditional PSI model are necessary.

Conclusion

In conclusion, it seems that the effectiveness of the PSI approach is based on the integration of its five basic features which are mastery orientation, self pacing, modularization, limited use of lectures, use of proctors, and frequent testing and feedback. Successful implementation of PSI also depends on the recognition and attention to a number of concerns which have been summarized here. The PSI approach is logically based on several tenets of good teaching: high student involvement in the

learning process, immediate feedback, mastery learning, and careful planning and instructional design of the course content.

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