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Appendix A: The Use of the Personalized System of Instruction (PSI)

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APPENDIX A: The Use of the Personalized System of Instruction (PSI)*

STUDY MODULES FOR THE USE OF THESE CBP MODULESRecommended

1. What is the Philosophy of PSI?
2. How Do I Manage This System?
3. The Care and Feeding of Student Tutors

Optional

4. How to Plan the Content of a Keller Plan Course
5. How to Design a Study Module
6. How to Write Learning Objectives

REFERENCES (not included in this Appendix)

1. J.G. Sherman (ed.), Personalized System of Instruction, 41 Germinal Papers, A selection of Readings on the Keller Plan (Benjamin, 1974).
2. F.S. Keller and J.G. Sherman, The Keller Plan Handbook, Essays on a Personalized System of Instruction (Benjamin, 1974).

These references may be ordered from the Center for Personalized Instruction, 29 Loyola Hall, Georgetown University, Washington, D.C. 20007.

STUDY MODULE 1: WHAT IS THE PHILOSOPHY OF PSI?INTRODUCTION

PSI (The Keller Plan) is based on learning theory. In this module you will read about "reward motivated learning": a method of making instruction more effective, relevant, and student-centered. Perhaps the most exciting way to become exposed to this revolution in learning is to read Fred Keller's article "Goodbye Teacher ...". The style is delightful and the content rich with information. (See p. 3 in Sherman's ...41 Germinal Papers, Reference 1.)

* Adapted from the PSI Workshop materials developed by Frank Six, Department of Physics and Astronomy, Western Kentucky University, Bowling Green, KY 42101. These materials were first used at the AAPT meeting, Reno, Nevada in June 1973.

LEARNING OBJECTIVES

When you have mastered the content of this module, you will be able to:

1. Keller plan - Given a list of descriptive terms, identify those that characterize the Keller Plan.
2. Success - List a minimum of two reasons why self-paced, supervised study is successful.

SUGGESTED STUDY PROCEDURE

To master the first learning objective, begin by reading the one-page description of "The Keller Plan" on p. 5 of the Michigan Memo to the Faculty. You will find it attached to this study module.

To satisfy the second objective, read the article by Ben A. Green, Jr., "Physics Teaching By the Keller Plan at MIT" [Am. J. Phys. 37, 7641 (1971)], or see p. 71 of Reference 1, and list the reasons Professor Green gives for the success of PSI at MIT.

PHILOSOPHY OF PSI

All of the learning objectives specified in this study module can also be achieved by digesting Keller's article "Goodbye, Teacher." Now try the Practice Test below.

RESOURCE MATERIALS

1. F. S. Keller, "Goodbye, Teacher . . ." [J. App. Behav. Anal. 1, 79-89 (1968)]; or p. 3 of Reference 1.
2. Memo to the Faculty, No. 48, April 1972, Center for Research on Learning and Teaching, University of Michigan, Ann Arbor, page attached.
3. B. A. Green, Jr., "Physics Teaching by the Keller Plan at MIT" [Am. J. Phys. 37, 764 (1971)], or p. 71 of Reference 1.

PRACTICE TEST

1. Which of the following features describe the Keller Plan?
 - (a) Regular lectures over the course subject matter.
 - (b) Course material subdivided into units.
 - (c) Advancement dependent upon student's demonstration of mastery of the learning objectives.
 - (d) All students proceed through the materials at the same rate (lock-step).
 - (e) Course objectives and procedures are explained in written study guides that are given to the student.
 - (f) Repeated testing without grade penalty.

- (g) Each student proceeds at his own rate of learning.
- (h) Grades based on student performance on three progress tests and a final exam.
- (i) Use of student tutors to individualize the instruction.

2. List two reasons given to account for the success of Keller-type courses.

STUDY MODULE 2: HOW DO I MANAGE THE SYSTEM?

INTRODUCTION

The previous module emphasized the benefits of PSI that accrue to the learner and to the teacher. If we arm the learner with descriptive objectives, relevant materials, and meaningful activities, he is free to go at his own pace and take part in as much or as little of the learning activities as he desires in order to achieve the objectives. He is given responsibility and control over his own efforts, with the guidelines and resource materials that he needs to advance and profit from the experience.

This unit will deal with management skills and course policy. Samples and suggestions will be presented, but the instructor will have considerable latitude in setting up his own rules.

LEARNING OBJECTIVES

When you have mastered the content of this module, you will be able to:

1. Policy statement - Write the course policy statement for your PSI course.
2. Management problems - Devise plans to handle the management problems of your course.

1. All of the features listed, with the exception of (a), (d), and (h), describe PSI. In addition, there are the following common characteristics: group instruction avoided, quizzes graded on the spot with oral tutor-student interaction (immediate feedback), student participation maximized, classroom becomes a study hall, instructor becomes a systems manager.

2. (a) Individual rates of learning, i.e., freedom; (b) frequent and positive feedback to the student, i.e., reward; (c) mastery of the units of study, i.e., success; (d) intensive involvement by the teacher and the students.

GENERAL COMMENTS

1. Aspects of PSI

Mastery: Demand excellence; settling for less degrades the spirit of the endeavor. Keller refers to the "Truman effect," that the job makes the man. The usual treatment of students that implies they are only worth a "C" is an insult. The expectation of excellence is a compliment, a challenge in response to which students do act in a new way (Sherman, p. 120, Reference 1).

Motivation: Make the first module appealing and easy to get the students started. After this the reinforcing nature of the system will take over. Make every effort to engage the learner in searching, discovering, and verifying. Provide a multi-media approach with student options, and insist on permanent storage characteristics and maximum accessibility.

Grades: Perhaps achievement of your core objectives might represent a three-credit "C" or a two-credit "B" (variable credit), with the core plus optional units for correspondingly higher grades. Isn't it more important to know a student's competencies in relation to desired accomplishments than in relation to other students' competencies?

2. System Management

Tutors: Prior students in the course can serve as tutors for academic credit plus the reward of learning the physics better. You may wish to consider choosing students who advance rapidly through the first several study units as tutors. Reward them for serving as tutors by excusing them from the final exam. Peers understand many of the difficulties better than do teachers, and praise from peers is probably more important than praise from teachers. Close supervision of tutors is recommended.

Procrastination: If you decide to hold quality constant and let time vary (the Keller tradition), some procrastination is bound to occur. Build in rewards for prompt performance. Give students graphs of the number of modules as a function of time with progress lines drawn on them.

Communications: With no attendance requirements, keeping in touch becomes a problem. Some have found it helpful to keep a "Keller Bulletin Board" in the learning center.

Logistics: Keep the learning center open as many hours as possible. Students should be able to obtain assistance and have quizzes graded without much delay.

SUGGESTED STUDY PROCEDURE

Read Chapter 4, Logistics, in The Keller Plan Handbook (see p. 24 of Reference 2). Then proceed to the Practice Test and answer the questions.

RESOURCE MATERIALS

1. The Keller Plan Handbook (Reference 2 on page 1).

PRACTICE TEST

1. How many students will be enrolled in your Keller class?
2. How many and what kinds of staff will you need?
3. How many hours per week will class be open?
4. When will students' quizzes be graded?
5. What type of classroom facilities/space will be desirable?
6. What will be your grading policy?
7. Do you intend to give a final exam?
8. Will your course really be self-paced?
9. How can you "help" students pace themselves?
10. What will you do with the procrastinators?
11. How will you handle incompletes?
12. How will you keep in touch with your students (communications)?
13. What functions will your tutors perform?
14. How will you reward the tutors?
15. What criteria will you use in choosing your tutors?
16. How will you (or will you) use the lecture mode?
17. How will you motivate the students?
18. What will you establish as the level of proficiency on test items (mastery)?
19. How will you maintain test question security and prevent cheating?
20. What kind of records will you maintain?

STUDY MODULE 3: THE CARE AND FEEDING OF STUDENT TUTORSINTRODUCTION

Student tutors play an essential role in the success of a Keller Plan course. In fact, the first time you use the Keller Plan you will probably discover that the students in the course prefer to ask the tutors for help rather than to ask you. The students feel more comfortable in exposing their ignorance to other students than to the instructor, who finally decides their grade. It is important to provide your tutors with a positive learning experience so that they can function effectively in your Keller Plan course. Hence, you need to think seriously about the care and feeding of your student tutors.

LEARNING OBJECTIVES

When you have mastered the content of this module, you will be able to:

1. Use of tutors - Construct a Keller Plan system that makes effective use of student tutors.

SUGGESTED STUDY PROCEDURE

To satisfy Objective 1, you should read all of the materials in References 1 and 2 that discuss the roll and selection of proctors. In Reference 2, see pp. 20 through 23 and 33, 38, and 39. Read articles #1, #5, and #29 in Reference 1.

A wide variety of procedures have successfully been used to attract and hold Keller Plan tutors. You need to examine the variety of systems that have been used and decide upon a system that will work at your institution. The secret of a successful tutoring system is to have enough so that the individual tutoring load is not too heavy (not more than 10 students per tutor) and to provide meaningful reward for the tutors.

PRACTICE TEST

1. How many student tutors will I need?
2. What reward will the tutors get? money? credit hours? a better grade in the course? a cup of coffee each week with the instructor? snake oil?

1. Number of students divided by 8 to 12.
2. Depends upon your institutional system.

STUDY MODULE 4: HOW TO PLAN THE CONTENT OF A KELLER PLAN COURSEINTRODUCTION

In this module you will consider general planning considerations: how to get organized, where to start. The questions raised here will indicate that "Kellerizing" your course is not something to be undertaken lightly. The commitment is a major one in terms of time and effort. The rewards are worth it.

LEARNING OBJECTIVES

When you have mastered the content of this module, you will be able to:

1. Kellerizing - List three decisions that require considerable thought on the part of the instructor as he prepares to Kellerize his course content.
2. Learner objectives - Recall various methods you might employ to select student competencies (learner objectives) that should result from your course.
3. Activity sequence - Given a list of Keller-course planning activities, order them in a chronological sequence.
4. Consolidation - Describe, in writing, Keller's suggestion for avoiding undue fragmentation of the course (the result of too much modularization) and for consolidating what the student has learned.

SUGGESTED STUDY PROCEDURE

Joel Greenspoon (Reference 1), Associate Dean of the Faculty at Temple Buell College, recommends the following procedure: First, decide what the student is to learn in the course. This is not easy for many instructors because they have not asked themselves this kind of question. When deciding on the content of the course, the decision should be made in terms of what the student is to do or say. To state that a student is to know, understand, or appreciate the effects of Copernican theory on scientific developments in the early stage of the Renaissance does not describe what the student is to do. To ask the student to describe (under certain conditions) these effects is telling the student what he is to do. To analyze critically some development does not describe the student's behavior, because the determination of critical analysis still rests with the instructor. It would be better to instruct the student to describe, in writing, the arguments for and against a given position. The clear specification of learning objectives is crucial. Sequencing the objectives so that students can proceed systematically through the course involves some trial and error. Second, decide how you will determine when the student has learned it. This implies a clear statement of how he is to do it. The instructor should provide explicit criteria by which the student's work is judged. Some instructors prefer the use of a written exam; others prefer an oral or a paper. Laboratory reports and skill testing are other ways in which the student might satisfy objectives. Despite the fact that faculty members have been judging students' work for years, they find it difficult to state explicitly the criteria by which they judge or evaluate the students' efforts. Third, decide what sources of information are pertinent to the objectives. Choose learning activities

that will facilitate learning by the students. Field trips, experiments, readings, lectures, and demonstrations should be considered. If self-pacing is one of your goals, lectures and demonstrations can be handled by making accessible audiotape and videotape, to ensure that the progress of any single student is not hindered. The above remarks should enable you to satisfy Objective 1.

Objective 2 is concerned with methods you might use to make the first decision - what should the student learn in the course. Remember the advice: think in terms of what the student is to do or say (student competencies). It is a simple matter to go through a book and identify all of the possible learning objectives. But which of those objectives define competencies (proficiencies, performances) that you want every student to take away from your course? Concentrate on the minimum learning objectives (core) as opposed to the "nice-but-not-necessary," enrichment-type objectives. Take a look at your old final exams. Are these competencies the most important? You might even go so far as to enlist the advice of colleagues (shudder). Deterline and Lenn (Reference 2) suggest performing a simulated task analysis: imagine the oral examination setting and develop a list of appropriate questions, problems, and tasks for each major course topic; sift out the core objectives by deleting the nonessential; consult other colleagues who teach the same course.

Your planning activities (Objective 3) might go like this:

- (1) Identify competencies desired (simulated task analysis, text, final exams, colleagues).
- (2) Determine criteria of evaluation (test items, practice exercises, study questions).
- (3) Write the minimum learning objectives based on (1) and (2).
- (4) Sequence the objectives and divide into study modules.
- (5) Specify the resource materials (learning activities).

A simpler prescription has been offered by Dr. Keller. See the page of the University of Nebraska newsletter PSI "A Guide to What, How, Why & Why Not of PSI" (attached, also Reference 3), and read the section PSI Instructional Tasks.

The advice concerning review modules applies to Objective 4. The CBP modules are examples of a course that was planned according to Keller's recipe.

Now, proceed to the Practice Test.

RESOURCE MATERIALS

1. J. Greenspoon, Assoc. Dean of Faculty, Temple Buell College, Denver, Colorado (private communication).
2. W. A. Deterline and P. D. Lenn, Coordinated Instructional Systems, Study Resource Materials Book (Sound Education, Inc., Palo Alto, Calif., 1972), pp. 14-17.
3. "A Guide to What, How, Why & Why Not of PSI," Instructional Media Center, 421 Nebraska Hall, University of Nebraska, Lincoln, NE 68588.

PRACTICE TEST

1. Write three tasks that Greenspoon recommends an instructor deliberate over during the planning of a Keller course.
2. Name two procedures useful in determining just what the student is to learn (student competencies) in your course.
3. Order the following activities in the sequence you would perform them as you plan the content of a Keller course:
 - (a) Perform a task analysis to identify the competencies students should be able to demonstrate when they have completed the course.
 - (b) State explicitly the conditions and the criteria by which you intend to evaluate the students performance; in other words, write test items or practice exercises that identify the competencies you want all of your students to attain.
 - (c) Write the minimum learning objectives (core) in performance terms, e.g., what the student is to do or say.
 - (d) Sequence the objectives; group them in study modules (prepare a course outline).
 - (e) Specify learning activities that will enable the student to satisfy the learning objectives, e.g., select resource materials, write practice tests.
4. What is Keller's recipe for consolidating what the student accomplishes in the separate study modules?

1. First, deciding what student competencies are to be attained; second, deciding what criteria you will use to judge the students competencies; third, deciding what learning activities will facilitate development of these competencies. These tasks are the foundation of a new surge in education circles - "competency-based education" (CBE), or "performance-based education" (PBE), and they are of central importance in the Keller method.

2. Perform a simulated task analysis, examine your old final exams, proceed through a textbook and identify learning objectives, talk with your colleagues. The order is correct, as stated. Some might suggest that first, decide what material you want to cover and second, divide it into short units. But, do you know what your destination is? The sequence (a) through (e) stresses learner outcomes (competencies). We'll have more to say about this in succeeding modules.

4. Include review modules.

STUDY MODULE 5: HOW TO DESIGN A STUDY MODULEINTRODUCTION

The preceding module dealt with deciding upon the goals you intend students to reach at the end of your course. It has been suggested that you select procedures, content, and methods appropriate to the objectives; cause students to interact with the subject matter in well-thought-out learning activities; and, evaluate the student's performance according to the objectives or goals that were selected. Assuming that you know what your destination is, this module concerns selecting the most efficient route to get the students there.

LEARNING OBJECTIVES

When you have mastered the content of this module, you will be able to:

1. Module components - List the components of a study module in the sequence they are presented to the student.
2. Function of components - Write descriptions of the function of each component of a study module and be able to distinguish between properly and improperly written components.
3. Instructor order - List the components of a study module in the order that they are developed by the instructor.
4. Developing modules - Describe a method of developing study modules that is initiated by constructing test items.

SUGGESTED STUDY PROCEDURE

The first objective refers to the order of presentation of the component information in a study module. If you read the CBP modules you will surely recognize the order: Introduction, Objectives, Procedure (including directions, resource materials, and finally, Practice Tests). The table below is patterned after material in Deterline and Lenn's manuals on Coordinated Instructional Systems (Reference 1). You should examine this table until you can satisfy Objective 2.

STUDY-MODULE COMPONENTS AND FUNCTIONS

Component	Function
Introduction	Tells the learner what the unit is about; identifies the topics; sets the scope; is brief, clear and interesting. Provides a concrete, familiar example of the physics contained in the module.
Learning Objectives	Tell the student what he will be able to do as a result of completing the unit; the competencies he will acquire and will be required to demonstrate.
Procedure	Facilitates learning by the student; directs the learner to the resource materials in the form of books, audio-visuals, lectures, demonstrations, models, and other instructional materials that have maximum accessibility; practice exercises and discussions identifying correct answers; indicates what to do, using which materials, located where, and why.
Practice Test	Provides a private progress evaluation to help the learner realize his own problems and decide what to do about them; measures the increase in observable competencies; provides practice in the use of the skills acquired.

The order in which the components of a study module are developed is not the same as the order of presentation to the student. It is suggested that you start by deciding what the successful learner is to be able to do at the end of the study module. If you follow the sequence below in developing study modules, then you are more apt to lead the student to the desired competencies.

Order of Development - Study-Module Components

- (1) Mastery Tests
- (2) Objectives
- (3) Procedure (learning activities, resource materials, practice exercises)
- (4) Introduction

Designing the mastery tests is an easier method of identifying objectives than the method of constructing learning objectives first. The test items will identify the competencies completely and provide a guide to show you what it is that you must prepare the student to do. In developing the test items, ask yourself, "What questions, problems or tasks do I want the learner to be able to answer, solve or perform; and what is the minimum acceptable performance?" Evans (Reference 2) put it this way: develop the test, teach the test, stop! (This should give you a hint about Objective 4.)

RESOURCE MATERIALS

1. Coordinated Instructional Systems, Lesson Book and Study Resource Materials Book (Sound Education, Inc., Palo Alto, Calif.), edited by W. A. Deterline and P. D. Lenn.
2. J. L. Evans, "Behavioral Objectives Are No Damn Good," Technology and Innovation in Education (Aerospace Education Foundation, Washington, D.C., 1967).
3. Sample Module: A CBP module, for example "Work and Energy."

PRACTICE TEST

1. List the components of a study module in the order they are presented to the learner.
2. What is the function of the Practice Test?
3. Does the Introduction in the CBP module "Work and Energy" fulfill the function of a properly written introduction?
4. List the components of a study module in the order of development by the instructor.
5. Describe the use of test items in identifying your learning objectives.

1. Introduction, Objectives, Procedure, Practice Test.
2. To provide the student a basis for progress evaluation. The test items should require the same behaviors that you desire the student to be able to perform.
3. It does identify the topics of the module, i.e., the scope; but, is it interesting? Students' comments should be solicited (feedback).
4. Test, Objectives, Procedure, Introduction.
5. A good test question calls for the desired accomplishment of instruction. This accomplishment (student competency) is the Objective.

STUDY MODULE 6: HOW TO WRITE LEARNING OBJECTIVES

INTRODUCTION

The advantage of clearly defined learning objectives is that the student knows where he is going, can tell what progress he is making, and can tell when he gets there. He can direct his attention to the essential information that he needs; and he can make more efficient use of his time. Minimum learning objectives fortify the instructor. Without them, there is no basis for evaluating a course, for selecting materials, or for choosing instructional methods. The core objectives referred to in the previous study module are the essential objectives that every student should take with him from the course. Some will say that trial and error has a place in education because students must learn to achieve in that kind of real world environment. If that be the case, we should develop "survival objectives" rather than hope students will pick them up in courses designed to develop other competencies.

LEARNING OBJECTIVES

When you have mastered the content of this module, you will be able to:

1. Instructional intentions - Given a list of objectives distinguish between those that do and do not communicate instructional intentions.
2. Criteria for discrimination - Differentiate between learning objectives that do and do not describe (a) the kind of performance or learner competency to be demonstrated, (b) the conditions under which the competency is to be demonstrated, and (c) the minimum acceptable performance.
3. Write learning objectives - Use content material and a list of action verbs to write learning objectives that accomplish all of the following:
 - (a) describe the learner's competency (behavior performance) to be demonstrated as evidence of accomplishment of the objective;
 - (b) identify the conditions under which competency is to be demonstrated;
 - and
 - (c) define the acceptable standards of competency.

SUGGESTED STUDY PROCEDURE

Mager says an instructional objective is an intent communicated by describing a proposed change in a student. It is a statement of what the student is to be like when he has successfully completed a learning experience. In other words, it is a description of a pattern of behavior (performance) that we want the student to be able to demonstrate. Everyone who is interested in teaching skills and knowledge to others should read Mager's book, Preparing Instructional Objectives (Reference 1).

The objectives in this study module are "content" objectives as opposed to "attitudinal" objectives. Bloom's books (Reference 2) discuss the various kinds of objectives you can choose. Whatever the objective, you should be detailed enough so that others understand your intent as you understand it.

The first objective in this module is concerned with communicating your instructional intent. Mager suggests you pose three questions to ensure that you do communicate effectively:

- (1) Does your statement describe the performance (behavior, competency) by name, that will be accepted as evidence that the learner has achieved the objective?
- (2) Does your statement identify the conditions (givens, restrictions) under which the learner must demonstrate his competency?
- (3) Does your statement describe how well the learner must perform to be acceptable (acceptable standards)?

The best way to couch your objectives in "performance terms" is to use action verbs that describe what the learner will be doing, e.g., to write, to identify, to discriminate, to solve, to repair, to construct, to draw, to list. Strive to avoid misinterpretation.

Often it is desirable to define the objective more precisely by stating the conditions that will be imposed on the learner when he is demonstrating his competency. Restrictions such as, "given such and such," "using only a voltmeter," and "without the aid of trig tables" might improve the ability of the objective to communicate. Ask yourself what the learner will be provided and what will he be denied. Does your objective exclude those learner responses that you do not want to elicit? If not, be more specific. One method of ensuring your objectives are understood is to provide examples or practice exercises. Note the use of this practice in the CBP modules.

Stating the minimum acceptable performance further specifies your learning goals. When appropriate, identify the standard or lower limit of acceptable performance, e.g., a time limit, a minimum number of correct responses, a percentage, or an accuracy. If you have followed the above remarks, then you should be able to satisfy the objectives of this study module. Try the Practice Test now.

RESOURCE MATERIALS

1. R.F. Mager, Preparing Instructional Objectives (Fearon, Palo Alto, Calif., 1962).
2. B.S. Bloom, Taxonomy of Educational Objectives, Handbooks I and II (David McKay, New York, 1956, 1964).
3. Verb List (attached).
4. CBP Modules, for example, "Work and Energy."

PRACTICE TEST

1. Which of the following learning objectives communicate instructional intentions?
 - (a) To develop an understanding of motion with constant acceleration.
 - (b) To appreciate the nature of physical law.
 - (c) To recite from memory
 - (d) To be able to repair a voltmeter.
 - (e) To write Newton's three laws of motion.
 - (f) To know how a laser works.
2. Which of the learning objectives in the "Work and Energy" Module are written in performance terms?
3. Which of the above objectives defines the standard of acceptable performance (criterion)?
4. Which of the above objectives specify the conditions under which the performance is to occur?
5. Do the three written objectives in this study module contain the items that are listed in Objective 3?

1. (c), (d), and (e) communicate, in performance terms, the instructional intentions. If you chose (a) what is the learner doing when he demonstrates that he understands? The objective (b) does not preclude or define any behavior. If the learner remarked, "I dig that, daddy-oh," it would be necessary to accept this as evidence of appreciation. The word "know" in objective (f) doesn't explain much either.
2. All of them are written in performance terms. Each names an act the learner would perform as he demonstrates he has accomplished the objective.
3. None do. This could be remedied by adding the criterion, "allowable error $\pm 5\%$ " or by specifying a time limit for solving the problems.
4. Most specify conditions, e.g., "on a scale diagram" "for example," "given a description of" "which includes" "when you are given a list of"
5. They (we hope) communicate the instructional intent by describing the performance, and by identifying the conditions. Only Objective 3 includes a criterion, "accomplish all the following." So, you see, there is room for improvement.

THE KELLER PLAN*

In a 1967 address Professor Fred Keller, a distinguished investigator of basic processes of learning, described to fellow educators a method of college teaching which breaks radically with past practices. In the five years since Keller's address, the method - sometimes known as "self-paced supervised study" but often called simply the Keller Plan - has been applied in numerous college courses around the country.

The work of a course taught by the Keller plan is divided into units. In a simple case, 15 units may be delineated which reflect the 15 chapters of the course text. A student starting the first unit is given a printed study guide that introduces the unit, describes its objectives, recommends procedures for studying to achieve these objectives, and includes sample questions. The student works individually on the unit, and must demonstrate his mastery of the material before moving on to the next unit in the sequence.

Mastery is ordinarily demonstrated by perfect or near perfect performance on a short-essay examination (Keller's preference for his introductory psychology course). The student may take an examination on a given unit whenever he feels ready, and failure to pass the test on the first try, the second, the third, or even later, is not held against him. However, he is given the study guide for the next unit only after he demonstrates mastery of the unit. Thus, students move at their own pace through a course from start to finish. A student may meet all course requirements in less than a semester, or he may not complete the course within the semester.

Throughout much of the course, the classroom simply functions as a study hall, where the student may read course material. Lectures and demonstrations are given less frequently than in a conventional course (perhaps six lectures in the course of a semester). In Keller's courses lectures and demonstrations were vehicles for motivation; they were not compulsory and no examination was based on them.

The staff for implementing the Keller Plan includes the instructor and undergraduate proctors. The instructor selects and organizes all study materials used in the course, and is responsible for the construction of examinations and for the final evaluation of each student's progress. A proctor is an undergraduate who has already completed the course and been chosen for his mastery of the course content and orientation, for his maturity of judgement, for his understanding of the special problems that confront students as beginners, and for his willingness to assist. The proctor receives academic credit for a significant learning experience. He provides students with study materials (except for textbooks) for the unit they are attempting and passes upon the successive mastery test as satisfactory or unsatisfactory. Course grades under the Keller Plan are usually based on the number of units of reading and the laboratory work successfully completed during the term and a final examination.

Keller (1968) summarizes those features of the plan that seem to distinguish it most clearly from conventional teaching procedures.

*By Dr. James A. Kulik of CRLT, from the Memo to the Faculty, April 1972.

- "(1) The go-at-your-own-pace feature, which permits a student to move through the course at a speed commensurate with his ability and other demands on his time.
- "(2) The unit-perfection requirement for advance, which lets the student go ahead to new material only after demonstrating mastery of that which preceded.
- "(3) The use of lectures and demonstrations as vehicles of motivation, rather than sources of critical information.
- "(4) The related stress upon the written work in teacher-student communication; and finally:
- "(5) The use of proctors, which permits repeated testing, immediate scoring, almost unavoidable tutoring, and a marked enhancement of the personal-social aspects of the educational process."

From letters received by the editors of a newsletter devoted to the Keller Plan (Sherman, 1971), it has been estimated that over 500 faculty members in a variety of disciplines have taught (or are about to teach) Keller-based courses. Not all the courses include all five of the features described by Keller; modifications have been introduced to fit a variety of local demands. A review (Kulik, 1972) of early reports on application of Keller-based plans makes several points:

1. Students taking Keller courses report spending a good deal of time on their studies. Several investigators report relatively high dropouts rates from Keller-based courses, and the most frequent comment from students who withdraw is that these courses are "too much work."
2. Students finishing Keller-based courses usually are given high grades. Since grades are assigned in a manner having little parallel in traditional courses, grade-distributions do not necessarily indicate that students learn more, but there are no reports of poorer learning under the Keller Plan.
3. In a number of comparisons, there are no significant differences on final-examination performances of students in Keller and conventional classrooms and in a few investigations, students studying under the Keller Plan do somewhat better on final examinations. Interpretation of these results must take into account dropout rates.
4. Most studies show that students completing Keller courses are highly satisfied with the learning method. In the University of Florida project, for instance, all students reported that they preferred the unit-performance format to typical course formats. Evidence showing strong student dissatisfaction with the Plan has not yet been presented. Interpretation of these results also must take into account dropout rates and grading practices.
5. There is some consensus among those who have used the Keller Plan that undergraduate students serving as proctors benefit especially from the method.
6. Several authors have noted the possible cost-savings to institutions using the Keller Plan. The use of undergraduate assistants is one basis for the economy.

VERB LIST*

SOME POSSIBLE VERBS FOR USE IN STATING COGNITIVE OUTCOMES†Bloom's Taxonomy of Educational Objectives

Knowledge - to recall and recognize.

Comprehension - to translate from one form to another.

Application - to apply or use information in a new situation.

Analysis - to examine a complex and break it down into its parts.

Synthesis - to put together information in a unique or novel way to solve a problem.

Evaluation - to make a judgment about something in light of some criteria.

<u>Knowledge</u>	<u>Comprehension</u>	<u>Application</u>	<u>Analysis</u>	<u>Synthesis</u>	<u>Evaluation</u>
define	translate	interpret	distinguish	compose	judge
repeat	restate	apply	analyze	plan	appraise
record	discuss	employ	differentiate	propose	evaluate
list	describe	use	appraise	design	rate
recall	recognize	demonstrate	calculate	formulate	compare
name	explain	dramatize	experiment	arrange	value
relate	express	practice	test	assemble	revise
underline	identify	illustrate	compare	collect	score
	locate	operate	contrast	construct	select
	report	schedule	criticize	create	choose
	review	show	diagram	set up	assess
	tell	sketch	inspect	organize	estimate
			debate	manage	measure
			inventory	prepare	
			question		
			relate		
			solve		
			examine		
			categorize		

THREE KINDS OF OBJECTIVES

Cognitive - to promote abilities in thought and understanding.

Attitudinal - to promote changes in attitude, feeling, or emotion.

Psychomotor - to promote improvement in physical or manipulative skills.

* R.B. & S.R. Johnson, Assuring Learning with Self Instructional Packages (Self Instructional Packages, Inc., Philippines, 1973).

† Compliments of Marybelle Savage.