

*"GOOD-BYE, TEACHER . . ."*<sup>1</sup>

FRED S. KELLER

ARIZONA STATE UNIVERSITY<sup>2</sup>

When I was a boy, and school "let out" for the summer, we used to celebrate our freedom from educational control by chanting:

Good-bye scholars, good-bye school;  
Good-bye teacher, darned old fool!

We really didn't think of our teacher as deficient in judgment, or as a clown or jester. We were simply escaping from restraint, dinner pail in one hand and shoes in the other, with all the delights of summer before us. At that moment, we might even have been well-disposed toward our teacher and might have felt a touch of compassion as we completed the rhyme.

"Teacher" was usually a woman, not always young and not always pretty. She was frequently demanding and sometimes sharp of tongue, ever ready to pounce when we got out of line. But, occasionally, if one did especially well in home-work or in recitation, he could detect a flicker of approval or affection that made the hour in class worthwhile. At such times, we loved our teacher and felt that school was fun.

It was not fun enough, however, to keep me there when I grew older. Then I turned to another kind of education, in which the reinforcements were sometimes just as scarce as in the schoolroom. I became a Western Union messenger boy and, between deliveries of telegrams, I learned Morse code by memorizing dots and dashes from a sheet of paper and listening to a relay on the wall. As I look back on those days, I conclude that I am the only

living reinforcement theorist who ever learned Morse code in the absence of reinforcement.

It was a long, frustrating job. It taught me that drop-out learning could be just as difficult as in-school learning and it led me to wonder about easier possible ways of mastering a skill. Years later, after returning to school and finishing my formal education, I came back to this classical learning problem, with the aim of making International Morse code less painful for beginners than American Morse had been for me (Keller, 1943).

During World War II, with the aid of a number of students and colleagues, I tried to apply the principle of immediate reinforcement to the early training of Signal Corps personnel in the reception of Morse-code signals. At the same time, I had a chance to observe, at close hand and for many months, the operation of a military training center. I learned something from both experiences, but I should have learned more. I should have seen many things that I didn't see at all, or saw very dimly.

I could have noted, for example, that instruction in such a center was highly individualized, in spite of large classes, sometimes permitting students to advance at their own speed throughout a course of study. I could have seen the clear specification of terminal skills for each course, together with the carefully graded steps leading to this end. I could have seen the demand for perfection at every level of training and for every student; the employment of classroom instructors who were little more than the successful graduates of earlier classes; the minimizing of the lecture as a teaching device and the maximizing of student participation. I could have seen, especially, an interesting division of labor in the educational process, wherein the non-commissioned, classroom teacher was restricted to duties of guiding, clarifying, demonstrating,

<sup>1</sup>President's Invited Address, Division 2, Amer. Psychol. Ass., Washington, D.C., Sept., 1967.

<sup>2</sup>Currently on leave of absence at the Institute for Behavioral Research, 2426 Linden Lane, Silver Spring, Maryland. Reprints may be obtained from the author, 3229 Park View Road, Chevy Chase, Maryland.

testing, grading, and the like, while the commissioned teacher, the training officer, dealt with matters of course logistics, the interpretation of training manuals, the construction of lesson plans and guides, the evaluation of student progress, the selection of non-commissioned cadre, and the writing of reports for his superiors.

I did see these things, of course, in a sense, but they were embedded deeply within a special context, one of "training" rather than "education". I did not then appreciate that a set of reinforcement contingencies which were useful in building simple skills like those of the radio operator might also be useful in developing the verbal repertoires, the conceptual behaviors, and the laboratory techniques of university education. It was not until a long time later, by a very different route, that I came to such a realization.

That story began in 1962, with the attempt on the part of two Brazilian and two North American psychologists, to establish a Department of Psychology at the University of Brasilia. The question of teaching method arose from the very practical problem of getting a first course ready by a certain date for a certain number of students in the new university. We had almost complete freedom of action; we were dissatisfied with the conventional approaches; and we knew something about programmed instruction. We were also of the same theoretical persuasion. It was quite natural, I suppose, that we should look for fresh applications of reinforcement thinking to the teaching process (Keller, 1966).

The method that resulted from this collaborative effort was first used in a short-term laboratory course<sup>3</sup> at Columbia University in the winter of 1963, and the basic procedure of this pilot study was employed at Brasilia during the following year, by Professors Rodolfo Azzi and Carolina Martuscelli Bori, with 50 students in a one-term introductory course. Professor Azzi's report on this, at the 1965 meetings of the American Psychological Association and in personal correspondence, indicated a highly satisfactory outcome. The new procedure was received enthusiastically by the students and by the university administration.

<sup>3</sup>With the aid of (Dr.) Lanny Fields and the members of a senior seminar at Columbia College, during the fall term of 1963-64.

Mastery of the course material was judged excellent for all who completed the course. Objections were minor, centering around the relative absence of opportunity for discussion between students and staff.

Unfortunately, the Brasilia venture came to an abrupt end during the second semester of its operation, due to a general upheaval within the university that involved the resignation or dismissal of more than 200 teachers. Members of the original psychology staff have since taken positions elsewhere, and have reportedly begun to use the new method again, but I am unable at this time to report in detail on their efforts.

Concurrently with the early Brazilian development, Professor J. G. Sherman and I, in the spring of 1965, began a series of more or less independent applications of the same general method at Arizona State University. With various minor changes, this work has now been tried through five semesters with an increasing number of students per term (Keller, in press [a], in press [b], 1967; Sherman, 1967). The results have been more gratifying with each successive class, and there has been as yet no thought of a return to more conventional procedures. In addition, we have had the satisfaction of seeing our system used by a few other colleagues, in other courses and at other institutions.<sup>4</sup>

In describing this method to you, I will start with a quotation (Keller, 1967). It is from a hand-out given to all the students enrolled in the first-semester course in General Psychology (one of two introductions offered at Arizona State University) during the past year, and it describes the teaching method to which they will be exposed unless they elect to withdraw from the course.

*"This is a course through which you may move, from start to finish, at your own pace. You will not be held back by other students or forced to go ahead until you are ready. At best, you may meet all the course requirements in less than one semester; at worst, you may not complete*

<sup>4</sup>For example, by J. L. Michael with high-school juniors on a National Science Foundation project at Grinnell College (Iowa), in 1965; and by J. Farmer and B. Cole at Queens College (New York) in a course similar to the one described here.

*the job within that time. How fast you go is up to you.*

*"The work of this course will be divided into 30 units of content, which correspond roughly to a series of home-work assignments and laboratory exercises. These units will come in a definite numerical order, and you must show your mastery of each unit (by passing a "readiness" test or carrying out an experiment) before moving on to the next.*

*"A good share of your reading for this course may be done in the classroom, at those times when no lectures, demonstrations, or other activities are taking place. Your classroom, that is, will sometimes be a study hall.*

*"The lectures and demonstrations in this course will have a different relation to the rest of your work than is usually the rule. They will be provided only when you have demonstrated your readiness to appreciate them; no examination will be based upon them; and you need not attend them if you do not wish. When a certain percentage of the class has reached a certain point in the course, a lecture or demonstration will be available at a stated time, but it will not be compulsory.*

*"The teaching staff of your course will include proctors, assistants, and an instructor. A proctor is an undergraduate who has been chosen for his mastery of the course content and orientation, for his maturity of judgment, for his understanding of the special problems that confront you as a beginner, and for his willingness to assist. He will provide you with all your study materials except your textbooks. He will pass upon your readiness tests as satisfactory or unsatisfactory. His judgment will ordinarily be law, but if he is ever in serious doubt, he can appeal to the classroom assistant, or even the instructor, for a ruling. Failure to pass a test on the first try, the second, the third, or even later, will not be held against you. It is better that you get too much testing than not enough, if your final success in the course is to be assured.*

*"Your work in the laboratory will be carried out under the direct supervision of a graduate laboratory assistant, whose*

*detailed duties cannot be listed here. There will also be a graduate classroom assistant, upon whom your proctor will depend for various course materials (assignments, study questions, special readings, and so on), and who will keep up to date all progress records for course members. The classroom assistant will confer with the instructor daily, aid the proctors on occasion, and act in a variety of ways to further the smooth operation of the course machinery.*

*"The instructor will have as his principal responsibilities: (a) the selection of all study material used in the course; (b) the organization and the mode of presenting this material; (c) the construction of tests and examinations; and (d) the final evaluation of each student's progress. It will be his duty, also, to provide lectures, demonstrations, and discussion opportunities for all students who have earned the privilege; to act as a clearing-house for requests and complaints; and to arbitrate in any case of disagreement between students and proctors or assistants. . . .*

*"All students in the course are expected to take a final examination, in which the entire term's work will be represented. With certain exceptions, this examination will come at the same time for all students, at the end of the term. . . . The examination will consist of questions which, in large part, you have already answered on your readiness tests. Twenty-five per cent of your course grade will be based on this examination; the remaining 75% will be based on the number of units of reading and laboratory work that you have successfully completed during the term."*

(In my own sections of the course, these percentages were altered, during the last term, to a 30% weighting of the final examination, a 20% weighting of the 10 laboratory exercises, and a 50% weighting of the reading units.)

A picture of the way this method operates can best be obtained, perhaps, by sampling the activities of a hypothetical average student as he moves through the course. John Pilgrim is a freshman, drawn from the upper 75% of his high-school class. He has enrolled in PY 112 for unknown reasons and has been assigned to a section of about 100 students, men and

women, most of whom are also in their beginning year. The class is scheduled to meet on Tuesdays and Thursdays, from 9:15 to 10:30 a.m., with a laboratory session to be arranged.

Together with the description from which I quoted a moment ago, John receives a few mimeographed instructions and some words of advice from his professor. He is told that he should cover two units of laboratory work or reading per week in order to be sure of taking an A-grade into his final examination; that he should withdraw from the course if he doesn't pass at least one readiness test within the first two weeks; and that a grade of Incomplete will not be given except in special cases. He is also advised that, in addition to the regular classroom hours on Tuesday and Thursday, readiness tests may be taken on Saturday forenoons and Wednesday afternoons of each week—periods in which he can catch up with, or move ahead of, the rest of the class.

He then receives his first assignment: an introductory chapter from a standard textbook and two "sets" from a programmed version of similar material. With this assignment, he receives a mimeographed list of "study questions", about 30 in number. He is told to seek out the answers to these questions in his reading, so as to prepare himself for the questions he will be asked in his readiness tests. He is free to study wherever he pleases, but he is strongly encouraged to use the study hall for at least part of the time. Conditions for work are optimal there, with other students doing the same thing and with an assistant or proctor on hand to clarify a confusing passage or a difficult concept.

This is on Tuesday. On Thursday, John comes to class again, having gone through the sets of programmed material and having decided to finish his study in the classroom, where he cannot but feel that the instructor really expects him. An assistant is in charge, about half the class is there, and some late registrants are reading the course description. John tries to study his regular text, but finds it difficult to concentrate and ends by deciding to work in his room. The assistant pays no attention when he leaves.

On the following Tuesday, he appears in study hall again, ready for testing, but anxious, since a whole week of the course has passed. He reports to the assistant, who sends him across the hall, without his books and

notes, to the testing room, where the proctor in charge gives him a blue-book and one of the test forms for Unit 1. He takes a seat among about 20 other students and starts work. The test is composed of 10 fill-in questions and one short-answer essay question. It doesn't seem particularly difficult and, in about 10 min John returns his question sheet and is sent, with his blue-book, to the proctor's room for grading.

In the proctor's room, in one of 10 small cubicles, John finds his special proctor, Anne Merit. Anne is a psychology major who passed the same course earlier with a grade of A. She receives two points of credit for about 4 hr of proctoring per week, 2 hr of required attendance at a weekly proctors' meeting, and occasional extra duty in the study hall or test room. She has nine other students besides John to look after, so she will not as a rule be able to spend much more than 5 or 10 min of class time with each.

Anne runs through John's answers quickly, checking two of them as incorrect and placing a question mark after his answer to the essay question. Then she asks him why he answered these three as he did. His replies show two misinterpretations of the question and one failure in written expression. A restatement of the fill-in questions and some probing with respect to the essay leads Anne to write an O.K. alongside each challenged answer. She congratulates John upon his performance and warns him that later units may be a little harder to master than the first.

John's success is then recorded on the wall-chart in the proctors' room, he is given his next assignment and set of study questions, and sent happily on his way. The blue-book remains with Anne, to be given later to the assistant or the instructor for inspection, and used again when John is ready for testing on Unit 2. As he leaves the room, John notices the announcement of a 20-min lecture by his instructor, for all students who have passed Unit 3 by the following Friday, and he resolves that he will be there.

If John had failed in the defense of one or two of his answers, he would have been sent back for a minimal period of 30 min for further study, with advice as to material most needing attention. If he had made more than four errors on his test, the answers would not have been considered individually; he would

simply have been told that he was not ready for examination. And, if he had made no errors at all, he would probably have been asked to explain one or two of his correct answers, as a way of getting acquainted and to make sure that he was the one who had really done the work.

John did fail his first test on Unit 2, and his first two tests on Unit 4 (which gave trouble to nearly everyone). He missed the first lecture, too, but qualified for the second. (There were seven such "shows" during the term, each attended by perhaps half of the students entitled to be there.) After getting through his first five units, he failed on one review test before earning the right to move on to Unit 6. On the average, for the remainder of the course, he required nearly two readiness tests per unit. Failing a test, of course, was not an unmixed evil, since it permitted more discussion with the proctor and often served to sharpen the concepts involved.

In spite of more than a week's absence from school, John was able, by using the Wednesday and Saturday testing sessions, to complete his course units successfully about a week before the final examination. Because of his cramming for other courses during this last week, he did not review for his psychology and received only a B on his final examination. His A for the course was not affected by this, but his pride was hurt.

Sometime before the term ended, John was asked to comment on certain aspects of the course, without revealing his identity. (Remember, John is a mythical figure.) Among other things, he said that, in comparison with courses taught more conventionally, this one demanded a much greater mastery of the work assignments, it required greater memorization of detail and much greater understanding of basic concepts, it generated a greater feeling of achievement, it gave much greater recognition of the student as a person, and it was enjoyed to a much greater extent (Keller, in press).

He mentioned also that his study habits had improved during the term, that his attitude towards testing had become more positive, that his worry about final grades had diminished, and that there had been an increase in his desire to hear lectures (this in spite of the fact that he attended only half of those for which he was qualified). When asked specifi-

cally about the use of proctors, he said that the discussions with his proctors had been very helpful, that the proctor's non-academic, personal relation was also important to him, and that the use of proctors generally in grading and discussing tests was highly desirable.

Anne Merit, when asked to comment on her own reactions to the system, had many things to say, mostly positive. She referred especially to the satisfaction of having the respect of her protees, of seeing them do well, and of cementing the material of the course for herself. She noted that the method was one of "mutual reinforcement" for student, proctor, assistant, and instructor. She suggested that it ought to be used in other courses and at other levels of instruction. She wondered why it would not be possible for a student to enroll in a second course immediately upon completion of the first, if it were taught by the same method. She also listed several changes that might improve the efficiency of the course machinery, especially in the area of testing and grading, where delay may sometimes occur.

In an earlier account of this teaching method (Keller, 1967), I summarized those features which seem to distinguish it most clearly from conventional teaching procedures. They include the following:

*"(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 upon 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 word 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 aspect of the educational process."*

The similarity of our learning paradigm to that provided in the field of programmed instruction is obvious. There is the same stress

upon analysis of the task, the same concern with terminal performance, the same opportunity for individualized progression, and so on. But the sphere of action here is different. The principal steps of advance are not "frames" in a "set", but are more like the conventional home-work assignment or laboratory exercise. "The 'response' is not simply the completion of a prepared statement through the insertion of a word or phrase. Rather, it may be thought of as the resultant of many such responses, better described as the understanding of a principle, a formula, or a concept, or the ability to use an experimental technique. Advance within the program depends on something more than the appearance of a confirming word or the presentation of a new frame; it involves a personal interaction between a student and his peer, or his better, in what may be a lively verbal interchange, of interest and importance to each participant. The use of a programmed text, a teaching machine, or some sort of computer aid within such a course is entirely possible and may be quite desirable, but it is not to be equated with the course itself." (Keller, 1967.)

Failure to recognize that our teaching units are not as simple as the response words in a programmed text, or the letter reactions to Morse-code signals, or other comparable atoms of behavior, can lead to confusion concerning our procedure. A well-known critic of education in America, after reading an account of our method, sent me a note confessing to "a grave apprehension about the effect of breaking up the subject matter into little packages." "I should suppose," he said, "it would prevent all but the strongest minds from ever possessing a synoptic view of a field, and I imagine that the coaching, and testing, and passing in bits would amount to efficient training rather than effectual teaching."

Our "little packages" or "bits" are no smaller than the basic conceptions of a science of behavior and cannot be delivered all at once in one large synoptic parcel. As for the teaching-training distinction, one needs only to note that it is always the instructor who decides what is to be taught, and to what degree, thus determining whether he will be called a trainer or a teacher. The method he uses, the basic reinforcement contingencies he employs, may be turned to either purpose.

Many things occur, some of them rather

strange, when a student is taught by a method such as ours. With respect to everyday student behavior, even a casual visit to a class will provide some novel items. For example, all the students seated in the study hall may be seen studying, undistracted by the presence or movements of others. In the test room, a student will rarely be seen chewing on his pencil, looking at a neighbor's blue-book, or staring out the window. In the crowded proctors' room, 10 pairs of students can be found concurrently engaged in academic interaction, with no couple bothered by the conversation of another, no matter how close by. Upon passing his assistant or instructor, in the corridors or elsewhere, a student will typically be seen to react in a friendly and respectful manner—enough to excite a mild alarm.

More interesting than this is the fact that a student may be tested 40 or 50 times in the course of one semester, often standing in line for the privilege, without a complaint. In one extreme instance, a student required nearly two terms to complete the work of one (after which he applied for, and got, permission to serve as a proctor for the following year).

Another unusual feature of our testing and grading is the opportunity given to defend an "incorrect" answer. This defense, as I noted earlier, may sometimes produce changes in the proctor's evaluation, changes that are regularly checked by the assistant or the instructor. Occasionally, a proctor's O.K. will be rejected, compelling the student to take another test, and sensitizing the proctor to the dangers of leniency; more often, it produces a note of warning, a correction, or a query written by the instructor in the student's blue-book; but always it provides the instructor with feedback on the adequacy of the question he has constructed.

Especially important, in a course taught by such a method, is the fact that any differences in social, economic, cultural, and ethnic background are completely and repeatedly subordinated to a friendly intellectual relationship between two human beings throughout a period of 15 weeks or more. Also, in such a course, a lonesome, ill-favored underprivileged, badly schooled, or otherwise handicapped boy or girl can be assured at least a modicum of individual attention, approval, encouragement, and a chance to succeed. The only prerequisite for such treatment is a well-

defined amount and quality of academic achievement.

Another oddity of the system is the production of a grade distribution that is upside down. In Fig. 1, are the results from a class of 208 students at Arizona State University during the past semester. Note the diminishing relative frequency as one moves from A to D. The category of E, indicating failure, is swollen by the presence of 18 students who failed to take up their option of W (withdrawal from the course). Grades of C and D were due to the failure of students to complete all the units of reading or laboratory before going into the final examination.

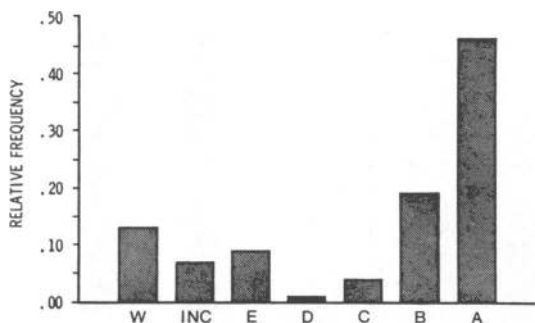


Fig. 1

Figure 2 shows data from the class 1 yr earlier. Essentially the same distribution holds, except for the category of Incomplete, which was then too easily obtainable. Discouraging the use of the Incomplete, together with the provision of more testing hours, apparently has the effect of regularizing study habits and equalizing the number of tests taken per week throughout the term.

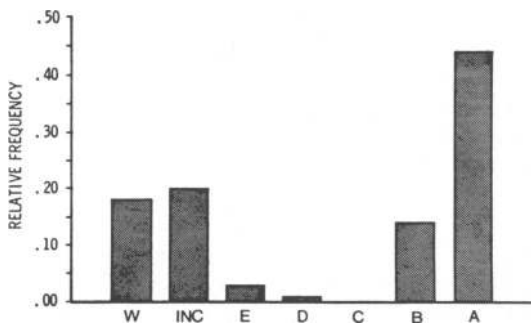


Fig. 2

In Fig. 3 (filled bars), the grade distribution is for a section of 25 students in an introduc-

tory course at Queens College (N. Y.) during the second semester of the past school year. The same method of teaching was employed as at Arizona State, but the work requirement was somewhat greater in amount. The distinctive feature here is the relative infrequency of low grades. Only four students received less than a B rating. Professor John Farmer, who provided me with these data, reports that the two students receiving F had dropped out of the course, for unknown reasons, after seven and eight units respectively.

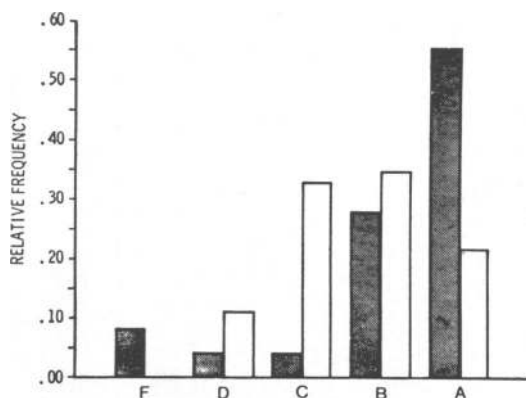


Fig. 3

With this teaching method, students who are presumably inferior may show up better upon examination than presumably superior students taught by more conventional procedures. Figure 4 shows two distributions of grades on a mid-term examination. The empty bars represent the achievement of 161 students of an Ivy League College, mainly sophomores, in the first semester of a one-year lecture-and-laboratory course in elementary psychology. The filled bars represent the achievement of 66 Arizona State University students, mainly freshman, on an unannounced mid-term quiz prepared by the Ivy League instructor and from which 13% of the questions had to be eliminated on the grounds of differential course coverage.

Relevant to this comparison is that pictured in Fig. 3. The grade distribution obtained by Professor Farmer (and his associate, Brett Cole) is here compared with one obtained from a section of 46 students in the same course, taught in the conventional manner by a colleague who is described as "a very good instructor". The filled bars show the Farmer-

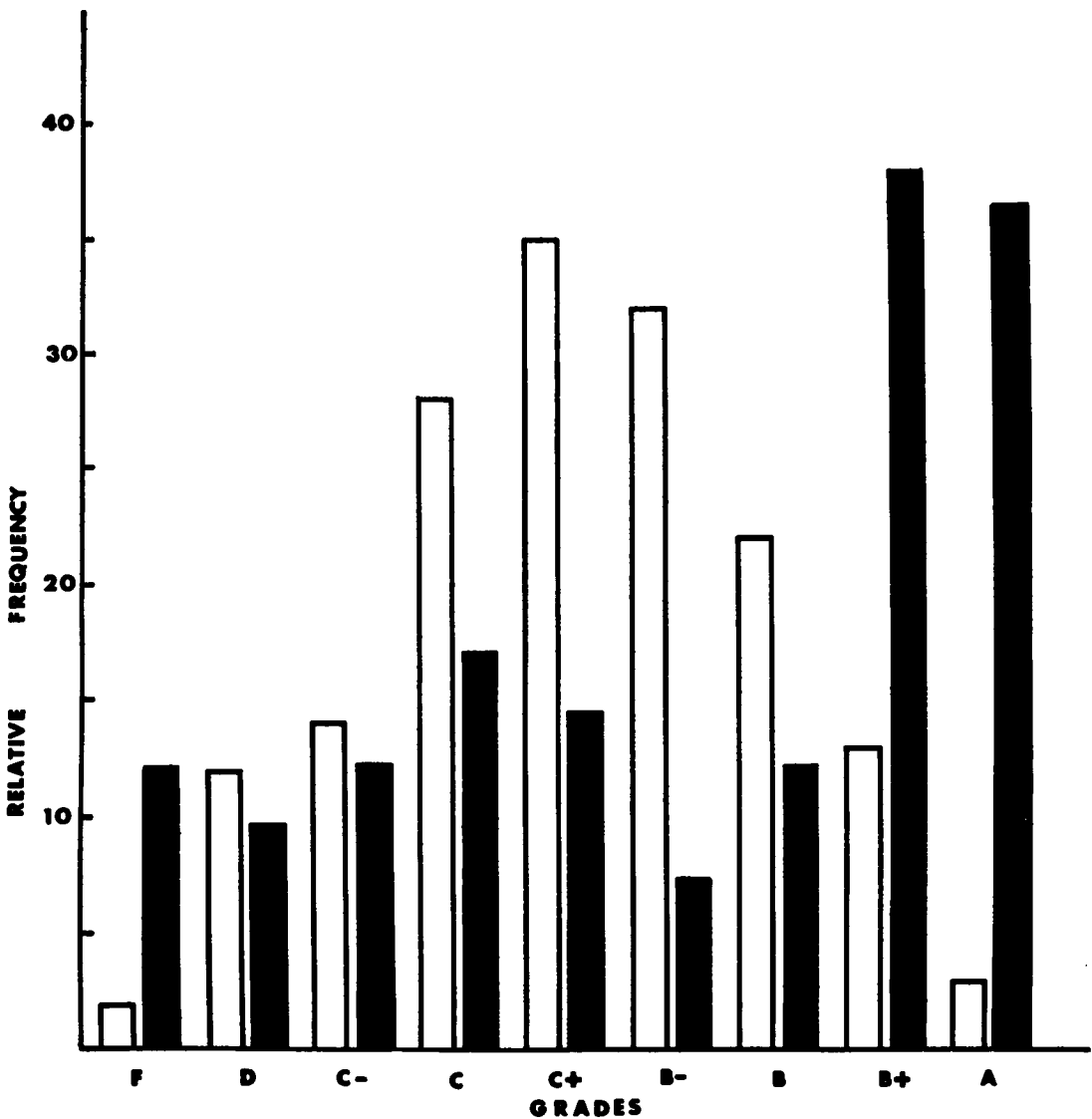


Fig. 4

Cole results; the empty ones are those from Professor Brandex.

Such comparisons are of some interest and may relieve the tedium of a lecture, but they raise many questions of interpretation, and their importance should not be over-emphasized. The kind of change needed in education today is not one that will be evaluated in terms of the percentage of A's in a grade distribution or of differences at the 0.01 (or 0.001) level of confidence. It is one that will produce a reinforcing state of affairs for everyone involved—a state of affairs that has heretofore been reached so rarely as to be the sub-

ject of eulogy in the world's literature, and which, unfortunately, has led to the mystique of the "great teacher" rather than a sober analysis of the critical contingencies in operation.

Our method has not yet required a grant-in-aid to keep it going. On one occasion we tried to get such help, in order to pay for mimeograph paper, the services of a clerk, and one or two additional assistants. Our request was rejected, quite properly, on the grounds that our project was "purely operational". Almost any member of a present-day fund-granting agency can recognize "research" when he



sees it. I do think, however, that one should be freed, as I was, from other university demands while introducing a system like ours. And he should not be asked to teach more than two such courses regularly, each serving 100 students or less, unless he has highly qualified assistants upon whom he can depend.

Neither does the method require equipment and supplies that are not already available to almost every teacher in the country. Teaching machines, tape recorders, and computers could readily be fitted into the picture. Moving pictures and television could also be used in one or two ways without detriment to the basic educational process. But these are luxuries, based on only partial recognition of our problem, and they could divert us from more important considerations. (Proctors, like computers, may go wrong or break down, but they can often be repaired and they are easily replaced, at very little expense.)

The need for individualized instruction is widely recognized, and the most commonly suggested way of filling this need is automation. I think that this solution is incomplete, especially when applied to the young; and I'd like to mention a personal experience that bears upon the matter.

In the summer of 1966, I made numerous visits to a center for the care and treatment of autistic children.<sup>5</sup> One day, as I stood at the door of a classroom, I saw a boy get up from his chair at the end of a class period and give a soft pat to the object on the desk in front of him. At the same time, he said, with a slight smile, "Good-bye, Teaching Machine!"

This pseudo-social behavior in this fundamentally asocial child amused me at the time. It reminded me of Professor Moore's description of the three-year-old who became irritated when his "talking typewriter" made a mistake, called the device a "big bambam", requested its name, and ended by asking, "Who is your mother?" Today, however, I am not so sure that this is funny. It does suggest that affection may be generated within a child for an electro-mechanical instrument that has been essential to educational reinforcement. Unfortunately, such a machine, in its present form, is unlikely to generalize with human beings in the boy's world, giving to them a highly desirable rein-

forcing property. In fact, the growth of this type of student-machine relation, if it were the only one, would be a poor substitute for a directly social interaction.

In an earlier report upon our method, I mentioned that it had been anticipated, partially or *in toto*, in earlier studies and I described one of these in some detail. As for current developments by other workers in our field, I have not made any systematic attempt to examine the offerings, even those that deal with college or university instruction. However, I have been impressed by several of them which seem to have points in common with ours, which have met with some success, and which will probably be increasingly heard from in the future.

One of these is the Audio-Tutorial Approach to the teaching of botany, developed by S. N. Postlethwait at Purdue University (Postlethwait and Novak, 1967). Another is the Socratic-Type Programming of general psychology by Harry C. Mahan (1967) and his associates at Palomar College, in California; and a third is the Interview Technique recently applied by C. B. Ferster and M. C. Perrott (1968) in teaching principles of behavior to graduate students in education at the University of Maryland.

Professor Postlethwait's method places great emphasis upon "independent study sessions" in which students carry out each individual work assignment in the course at their own pace, by means of the extensive use of tapes and films. Teaching assistants provide for oral quizzing on major concepts and help the students with difficult assignments. Weekly "small assembly sessions" are used primarily for recitation and the discussion of problems or small research projects; and "general assembly sessions" deal mainly with motivational materials. Postlethwait reports high student interest and greatly improved performance with the use of this technique. "Grades have risen from 6% A's under the conventional system to as high as 25% A's in some semesters. Failures have decreased from 20% in the conventional system to as few as 4%."

"Socratic-Type Programming" is described by Professor Mahan as "a philosophy and technology of instruction which emphasizes student response rather than presentations by the teacher. Its basic media consist of exercises

<sup>5</sup>At the Linwood Children's Center, Ellicott City, Maryland.

made up of questions and short answers covering the content of a standard text, the text itself, tapes for recording the questions in the exercises, a classroom tape recorder for administering tests, tape duplicating facilities, a listening center in the college library, and student owned tape recorders for home use whenever possible. Classroom time is devoted largely to the discussion of points covered by the questions. All examinations are the short-answer type and are presented aurally on tape." Students must pass three periodic tests with a score of 85% or better before they are permitted to take a comprehensive final examination. The method does not yet permit "multiple exit" from the course, but Mahan says it is "tending very much in that direction." (1967.)

The Interview Technique, as described by Ferster and Perrott, does permit students to complete the course at different times, and it also approximates the student-and-proctor feature. Progress through the course is possible by verbalizing successive units of course content in a lengthy series of short interviews. The interviews are conducted mainly between students currently enrolled in the course, and any student is free to leave the course when all of his reading assignments have been adequately covered. The interviewer may sometimes be a staff member, as at the beginning of the course, but generally he is a student who has already been interviewed by someone else on the topic in question. The interviews are highly formalized, with the interviewer playing the role of the listener, checker, appraiser, and summarizer. Each interview is an open-book affair, but of such short and sharply-defined duration (10 min, as a rule) that the student can do no more than cue himself by reference to the printed page.

The goal of this method is nothing less than fluency with respect to each main feature of the course. Lectures, group discussions, and demonstrations are available at certain times, contingent upon a given stage of advance. Inadequate interviews are rejected, in whole or part, without prejudice, and with suggestions for further study. A product of high quality is guaranteed through staff participation at critical points. A modification of this procedure, which is to include written tests and the employment of advanced-student proctors, is planned by Professor Ferster for the introduc-

tory course in psychology at Georgetown University during the coming semester.

In systems like these, and in the one I have centered on, the work of a teacher is at variance with that which has predominated in our time. His public appearances as classroom entertainer, expositor, critic, and debater no longer seem important. His principal job, as Frank Finger (1962) once defined it, is truly "the facilitation of learning in others." He becomes an educational engineer, a contingency manager, with the responsibility of serving the great majority, rather than the small minority, of young men and women who come to him for schooling in the area of his competence. The teacher of tomorrow will not, I think, continue to be satisfied with a 10% efficiency (at best) which makes him an object of contempt by some, commiseration by others, indifference by many, and love by a few. No longer will he need to hold his position by the exercise of functions that neither transmit culture, dignify his status, nor encourage respect for learning in others. No longer will he need to live, like Ichabod Crane, in a world that increasingly begrudges providing him room and lodging for a doubtful service to its young. A new kind of teacher is in the making. To the old kind, I, for one, will be glad to say, "Good-bye!"

I started this paper on a personal note and I would like to end it on one. Twenty-odd years ago, when white rats were first used as laboratory subjects in the introductory course, a student would sometimes complain about his animal's behavior. The beast couldn't learn, he was asleep, he wasn't hungry, he was sick, and so forth. With a little time and a handful of pellets, we could usually show that this was wrong. All that one needed to do was follow the rules. "The rat," we used to say, "is always right."

My days of teaching are over. After what I have said about efficiency, I cannot lay claim to any great success, but my schedule of rewards was enough to maintain my behavior, and I learned one very important thing: *the student is always right*. He is not asleep, not unmotivated, not sick, and he can learn a great deal if we provide the right contingencies of reinforcement. But if we don't provide them, and provide them soon, he too may be inspired to say, "Good-bye!" to formal education.

REFERENCES

- Ferster, C. B. and Perrott, M. C. *Behavior principles*. New York: Appleton-Century-Crofts, 1968. Pp. 542.
- Finger, F. W. Psychologists in colleges and universities. In W. B. Webb (Ed.), *The profession of psychology*. New York: Holt, Reinhart and Winston, 1962. Pp. 50-73.
- Keller, F. S. Studies in international morse code: I. a new method of teaching code reception. *Journal of Applied Psychology*, 1943, 27, 407-415.
- Keller, F. S. A personal course in psychology. In R. Ulrich, T. Stachnik, and J. Mabry (Eds.), *The control of behavior*. Glenview, Ill.: Scott, Foresman, 1966. Pp. 91-93.
- Keller, F. S. Neglected rewards in the educational process. *Proc. 23rd Amer. Conf. Acad. Deans*, Los Angeles, Jan., 1967. Pp. 9-22.
- Keller, F. S. New reinforcement contingencies in the classroom. In *Programmiertes lernen*, Wissenschaftliche Buchgesellschaft, Darmstadt, in press.
- Keller, F. S. Engineering personalized instruction in the classroom. *Rev. Interamer de Psicol.*, 1967, 1, 189-197.
- Keller, F. S. and Schoenfeld, W. N. The psychology curriculum at Columbia College. *American Psychologist*, 1949, 4, 165-172.
- Mahan, H. C. The use of Socratic type programmed instruction in college courses in psychology. Paper read at West. Psychol. Ass., San Francisco, May, 1967.
- Postlethwait, S. N. and Novak, J. D. The use of 8-mm loop films in individualized instruction. *Annals N. Y. Acad. Sci.*, Vol. 142, Art. 2, 464-470.
- Sherman, J. G. Application of reinforcement principles to a college course. Paper read at Amer. Educ. Res. Ass., New York, Feb., 1967.

Received 27 October 1967.