PROGRAMMED INSTRUCTION IN THE PLANT

machines teach shop math and blueprint reading to American Can Employees

WILLIAM L. STUART
Corporate Manager, Plant Employee Training, American Can Company, New York, New York.

"This is asking too much," smiled the union official. "You'll never get grown men to sit down at a machine and teach themselves."

We chuckled. Then we made a challenge.

"Pick six of your experienced shop men. We'll give each man a simple pencil test on a subject he should already know, Shop Math and Blueprint Reading. Then we'll sit each of these men down before one of our Auto-Tutor machines and have him go through our new course. *After* each man has completed our course, we will give him the same paper and pencil test to find out what the machine has taught him.

The union official agreed. By this time he was both enthusiastic and curious about the machine and the test. He suggested that we use for the test a six-man local Union Committee made up of men holding different types of shop jobs.

This was fine with us. We knew we had something good. An enthusiastic Union Committee would help us stir up interest in the AutoTutor among our employees. There was more good-natured joshing but by now there was serious interest in what the teaching machine would actually accomplish.

We gave the men on the panel the pencil and paper test covering the course material and locked the scores away in a desk.

AT THE MACHINE

Then the first man took his place at the AutoTutor machine. He pushed the first button. The first text and question and multiple-choice answers appeared before him on the illuminated screen. He was faced with a choice. He was forced to think. In minutes nothing was heard in the room except the click of the Auto-Tutor as he pushed buttons and brought new frames before him on the screen. He became totally absorbed.

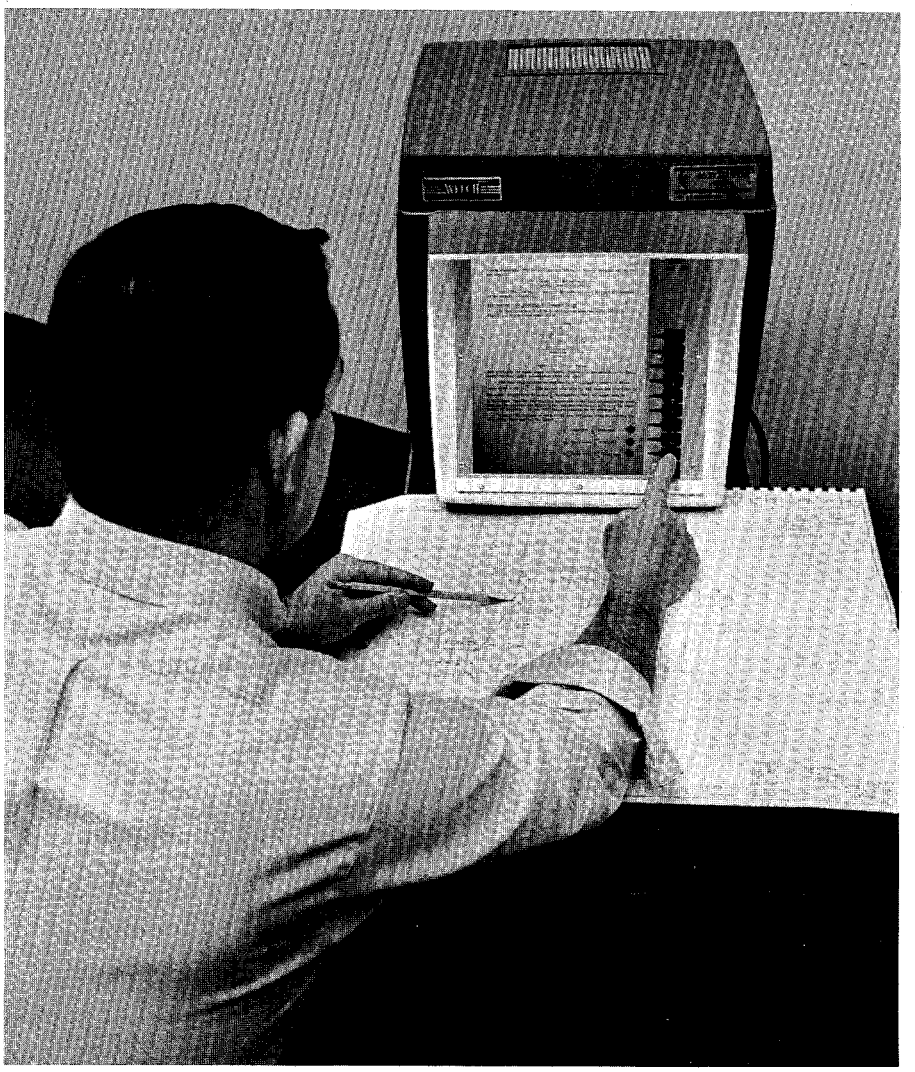
Others followed him at the machine. It took some men longer time to complete the first unit than others. Time variations ranged from three hours to ten hours. This itself impressed the union official as well as the men on the panel for it demonstrated how the AutoTutor machine can accommodate itself to any man's intellectual capacity.

When all the men had finished the first unit of programmed instruction, everyone was eager to hear the results. Had the machine accomplished very much in increasing the knowledge of the men? The results said Yes. Here they are:

Test of Efficiency of AutoTutor Instruction

Six-Man Union Committee

Job Title	*Score before AutoTutor*	*Score after AutoTutor*
Mechanic	63	93
Electrician	83	100
Mechanic Trainee	70	90
Machinist	70	100
Lift Truck Operator	60	93
Car Checker	83	100
Average	71	96



The men were deeply impressed when they took the second paper and pencil test and found out how much they had learned. They now were convinced that AutoTutor instruction not only has merit, they asked that its use be extended throughout the plant. The test results are truly significant.

Out of six men, three, or half of those participating were able to score 100 through use of the AutoTutor. This particular local union is now one of our biggest boosters for programmed AutoTutor teaching.

MULTI-PLANT TESTS

So we had a success. What next? On the basis of this one test alone should we extend the AutoTutor program to other plants? Possibly. But first, why not verify the effectiveness of the method by a broader test?

We did. Using the same technique as with the union committee, we conducted another study with 100 employees at 12 different geographical locations.

Again we encountered skepticism. And again the participants became our greatest boosters. Further, we now had factual data to support our decision to expand the program to other areas. Shown below are the results of the multi-plant tests of the AutoTutor with 100 employees in diversified jobs.

We now knew that we had something spectacular. We had a method of training our people that we could control, and which involved only the employee and the machine! No more uncertain instructors. No more classes at odd hours. The AutoTutor would do it all and we could be certain of the content of the program.

Today this first programmed course, Shop Math and Blueprint Reading, is taught by AutoTutor at 51 American Can plants in the United States, Canada and Puerto Rico.

$83,500 ANNUAL SAVINGS

Since its introduction in 1964, the AutoTutor has been a real money saver for our company. Before we adopted this fast and exciting method of teaching Shop Math and Blueprint Reading, we were spending $100,000 a year for trade and correspondence school fees and to employees for hours spent either in classroom or home study beyond their normal eight-hour day.

We are now training these men on the job more effectively and with better retention within their normal eight-hour day. The only cost is the rental of the AutoTutor and this means a net savings to the company for this one course alone of $83,500 per year.

Pre-Test before Using AutoTutor	*Post-Test after Using AutoTutor*
Low 10%	Low 70%
High 87%	High 100%
Average 61.5%	Average 86.1%

Learning Time for Entire 7 Unit Course

Minimum ----- 13 hours, 50 minutes
Maximum ----- 57 hours, 30 minutes
Average-------- 24 hours, 10 minutes

Previously we were requiring our mechanical trainees to take 216 hours of related training in Shop Math and Blueprint Reading.

Now a slow-to-grasp employee can get the same material in less than 58 hours; a quick-to-grasp employee in less than 14 hours; and an average employee in less than 25 hours. So not only is the company benefiting, employees are benefiting by access to a faster method of learning their jobs and improving their efficiency. Everybody wins.

P.I. – WHAT IT IS

A programmed AutoTutor course is a package of learning on film. Seated before the AutoTutor, with a series of buttons at hand to activate the machine, a student is taught the content of a subject, tested on his retention as he progresses in the course, and finally is examined on what he has learned.

The AutoTutor is the teacher. The buttons of the machine are the interrogators. Push Button A, and there before you on the screen is text with a clearly stated question and a series of possible answers. You are asked which answer is correct. You think. You make your choice by pushing a button.

If right, you are told so and the next sequence of text, questions and multiple choice answers appear on the screen. But if you are wrong, you are referred to a return button, which, when pushed, will switch you back to earlier material you obviously need to know.

This is called Branching. It is a brief (or lengthy) detour from the mainstream of the course to make certain the student clearly grasps the material before going on. It means that a student working with the AutoTutor always has access to review instruction before undertaking something new. In fact, he cannot undertake the new until he has demonstrated his grasp of the old.

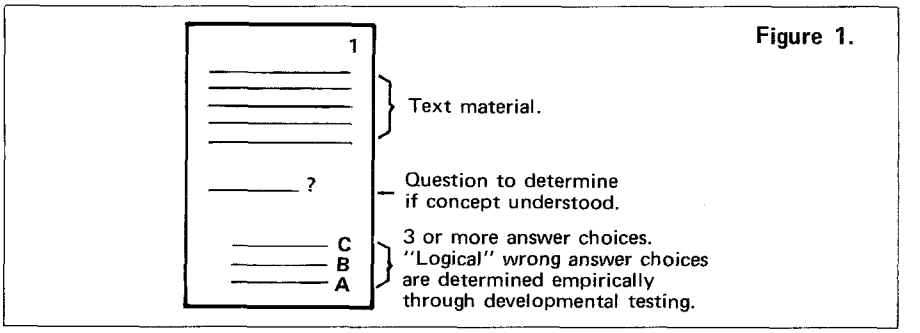
In addition, before starting a lesson, the student can, if he elects, take a pre-test on the AutoTutor which, passed successfully, will permit him to bypass the lesson and go on with new work. Thus the AutoTutor frees the knowledgeable employee to go just as fast as his capacity permits. Training time is reduced and boring repetition is avoided. But no skipping! A final test administered by the AutoTutor is a requirement for all.

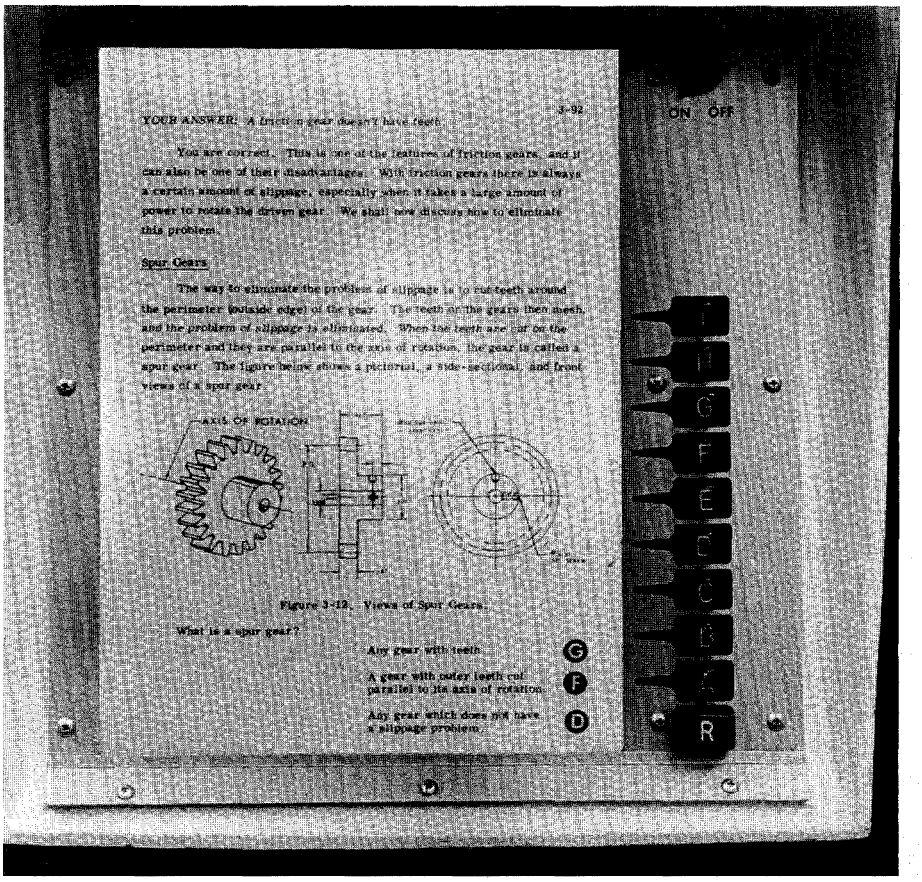
Consider the results achieved through programmed instruction: since all students must attain a predetermined level of comprehension to complete the course, the *learning* factor is constant. And, unlike our traditional methods of instruction, the *time* factor becomes variable. We feel this in itself is a strong argument in favor of the self-pacing AutoTutor.

How does the AutoTutor teach, test and reinforce? Pictured below is an actual frame from our course on Math and Blueprint Reading.

1. This frame appears on the screen of the AutoTutor. It teaches a concept about Blueprint Reading. A question is asked to determine if the student understands the concept. To answer the question, the student has three or more choices. Only one is correct. Others have been determined empirically through developmental testing.

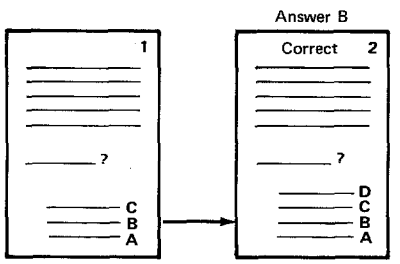
Figure 1.





2. The student studies the screen. He makes up his mind which answer is correct. He pushes the indicated button. He has chosen correctly! The AutoTutor clicks. The next frame is before him. He is told the answer is correct and is then presented with new material to learn. The question and answer procedure continues, precisely as though he was in a classroom being taught by a live teacher.

Figure 2.



3. But suppose he pushes the button for the *wrong* answer? The AutoTutor puts up on the screen a "wrong answer" frame. The student is told immediately his answer is not correct and then presented with remedial instruction to correct the misconception he revealed in his answer choice. What happens next? He is told to press the R (return) button. (This is the only button which will work). The original text frame reappears. He tries again. Just exactly like a live teacher making his pupil do his work over after a wrong answer. (See Figure 3.)

4. Parallel to the mainstream of instruction, optional lessons may be made available. For example, if, in preparing a lesson in a math course, we decided some students need a refresher in decimals, a separate "branch" to review decimals may be included. Students who arrive on a wrong answer page will be required to take the refresher branch. Figure 4 shows how a parallel branch is provided to present enrichment material on an optional basis or to force a review of the material when the student fails to correctly answer a critical question.

Figure 3.

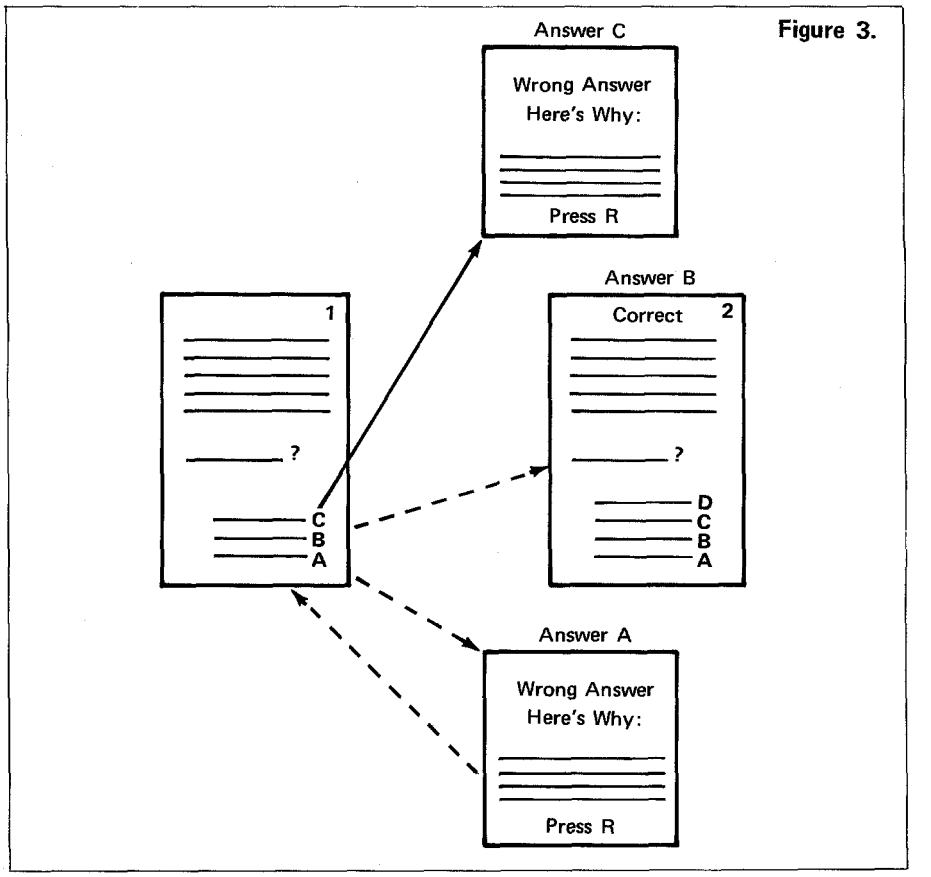
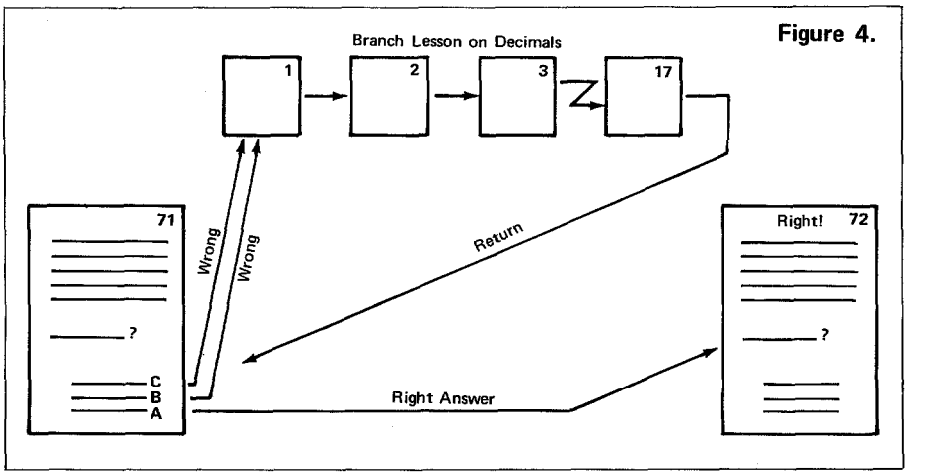


Figure 4.

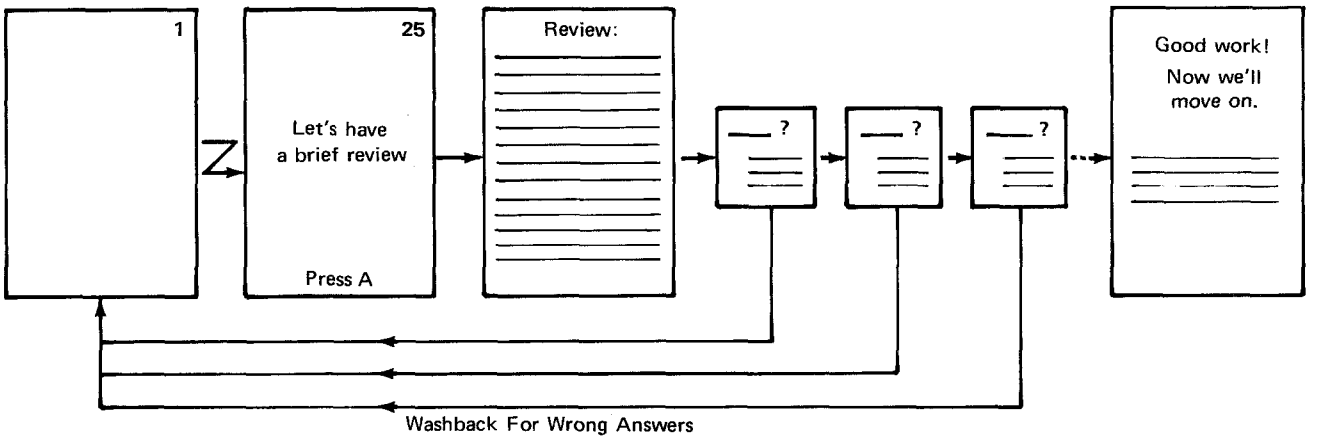


Branch lesson frames are prepared with the same format as those in the mainstream, i.e., multiple choice questions, wrong answer frames, etc.

5. Frequent reviews, during the course and at the finish, tie together concepts on which the student is tested. Each narrative review is followed by a series of questions or problems to be solved. If a student misses any one of the correct answers, AutoTutor sends him back to the beginning of the section or lesson and requires him to work his way through the text material again. (See Figure 5.)

6. An end-of-lesson review, followed by critical questions or problems, helps to evaluate the student's comprehension. During this review if the student fails to

Figure 5.



answer a question correctly, he will be brought back to that part of the lesson which needs to be reinforced. He then again works his way forward to the end-of-lesson review. (See Figure 6.)

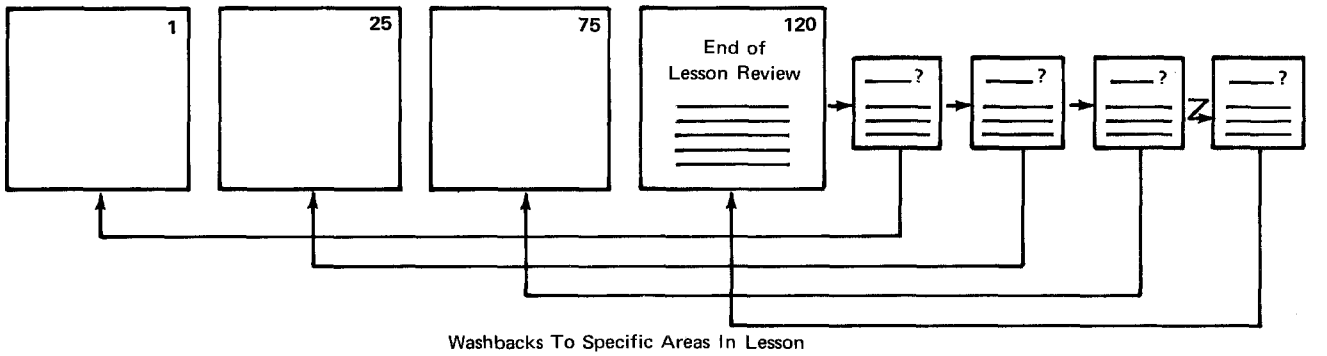
End-of-lesson reviews serve another purpose. They enable AutoTutor to protect against guessing in answering pre-lesson questions. The student who by luck pushes the right buttons and gets by the main content of the course still will have to take the end-of-lesson review. If he fails in this review, AutoTutor sends him back to the first frame of the lesson.

RESISTANCE TO TESTING

Some labor unions have strongly resisted any form of tests. Their philosophy has been that you can't determine whether an employee can learn the job until you give him a chance to try it. Job performance is what counts — not a test score.

The AutoTutor has answered this problem. The end-of-lesson review is actually a test — but not a test in the sense of pass or fail. If all questions are not answered correctly, there is no failure — the student is forced to return to the beginning and start over again. Failure only occurs if an individual cannot complete the program after repeated attempts.

Figure 6.



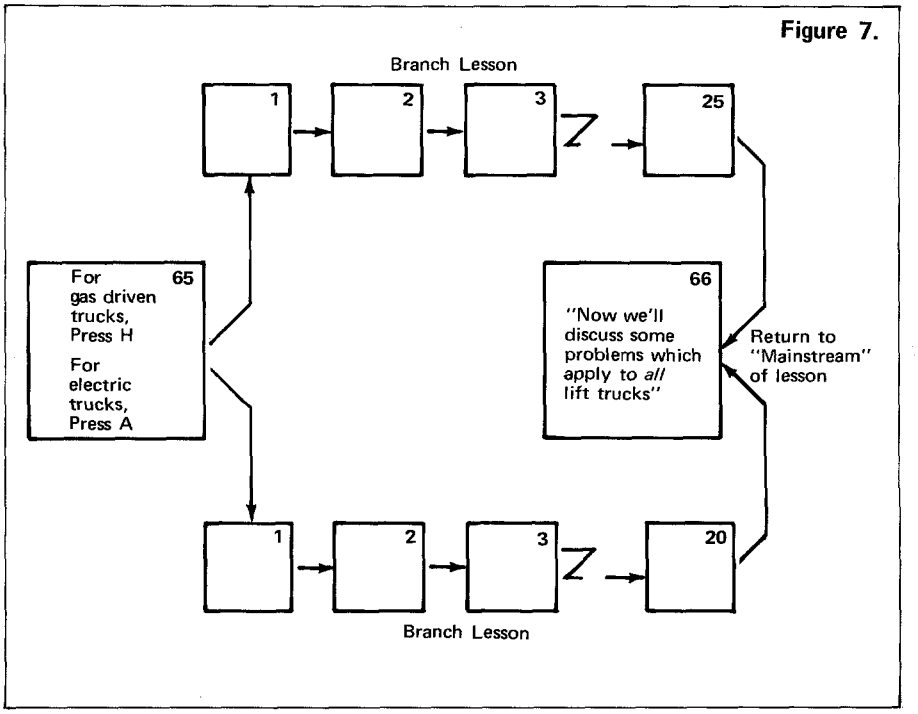


Figure 7.

WE'RE HAPPY

The Shop Math and Blueprint Reading course for the AutoTutor was enthusiastically welcomed by management. Unions like it and so do our employees. We are convinced that this teaching method really teaches. Now we write our own programs. In addition our New York Graphic Arts Department has developed a full production capability for making the film.

Recently we completed an AutoTutor program in color for Forklift Truck Drivers. The program has two branches, one for gasoline trucks and one for electric trucks as shown below. There is also a separate lesson for L.P.G. trucks.

Other AutoTutor programs under development are a Quality Control program, a Safety program for supervisors, and an Indoctrination program for new supervisors.

Our International Operations became interested in the Shop Math and Blueprint Reading course and we now are translating these courses into Spanish for our subsidiary operations in Puerto Rico, Mexico and South America.

From a modest beginning in 1964, we now have 100 AutoTutors at various company locations and we cannot keep up with the demand for additional programs.

Not only do we expect to improve job performance by developing instruction programs where none existed before and by improving existing programs, but we will generate company income through the sales, by an outside distributor, of programs we create which have industry-wide application. Our courses in Shop Math and Blueprint Reading, and Forklift Truck Operation are now available to outside firms on this basis. One vice president recently remarked, "This is the first time I've seen the Employee Relations Department make money for the company — they usually give it away!"