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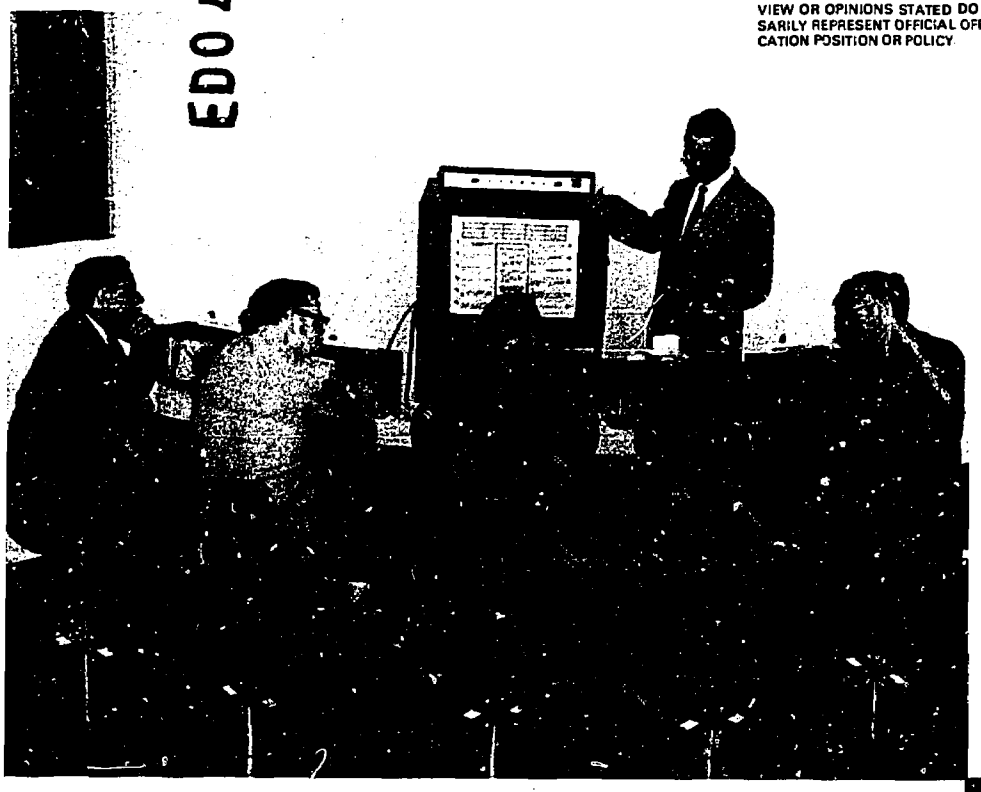
ABSTRACT

This study evaluated the use of the Allen group teaching machines in a basic skills program (arithmetic, language arts, General Educational Development preparation) at the Federal Correctional Institution (FCI), Lompoc, California. Out of 317 eligible inmates, 172 enrolled. The evaluator interviewed inmates, teachers, and prison administrators, and collected data for comparisons between the Lompoc program and other approaches. Machines displayed the special advantage of defining the teacher role as benign and supportive. The teachers, who became primarily observers of the learning process and evaluators of programing effectiveness, have tended to receive their new role favorably. The inmates clearly preferred machines for learning facts by rote. Student grade year gains ranged from .8 (on a 20 hour verbal skills course) to 2.4 (in a 13.5 hour number facts course), with an overall mean gain of 1.4 grades for 24 hours of study. Results achieved in the FCI program seemed to compare favorably with those from other methods. Systematic dissemination of the Allen teaching machines throughout the Federal panel system was urged. (Included are educational statistics, special reports, questionnaires, and estimates of cost and personnel needs.) (LY)



ALLEN TEACHING MACHINE

...*an evaluation*

HUMAN INTERACTION RESEARCH INSTITUTE

FEDERAL PRISON INDUSTRIES, INCORPORATED
T. WILLINGHAM ASSOCIATE COMMISSIONER

AN EVALUATION OF THE EFFECTIVENESS OF THE ALLEN TEACHING MACHINE AT THE FEDERAL CORRECTIONAL INSTITUTION, LOMPOC, CALIFORNIA.

FINAL REPORT
to Bureau of Prisons
Department of Justice

Contract Jlc-22,007

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PREFACE

This evaluation was made at the request of the Bureau of Prisons. Its purpose is to provide an independent estimate of the implications of the use of group teaching machines at the Federal Correctional Institution at Lompoc, California for the entire federal prison system. For the past two years the Bureau has supported experimentation with the teaching machines developed by Mr. Byron Allen, FCI Lompoc Education Specialist. It has now requested this evaluation to aid it in making a decision regarding the dissemination of that teaching machine program to other institutions.

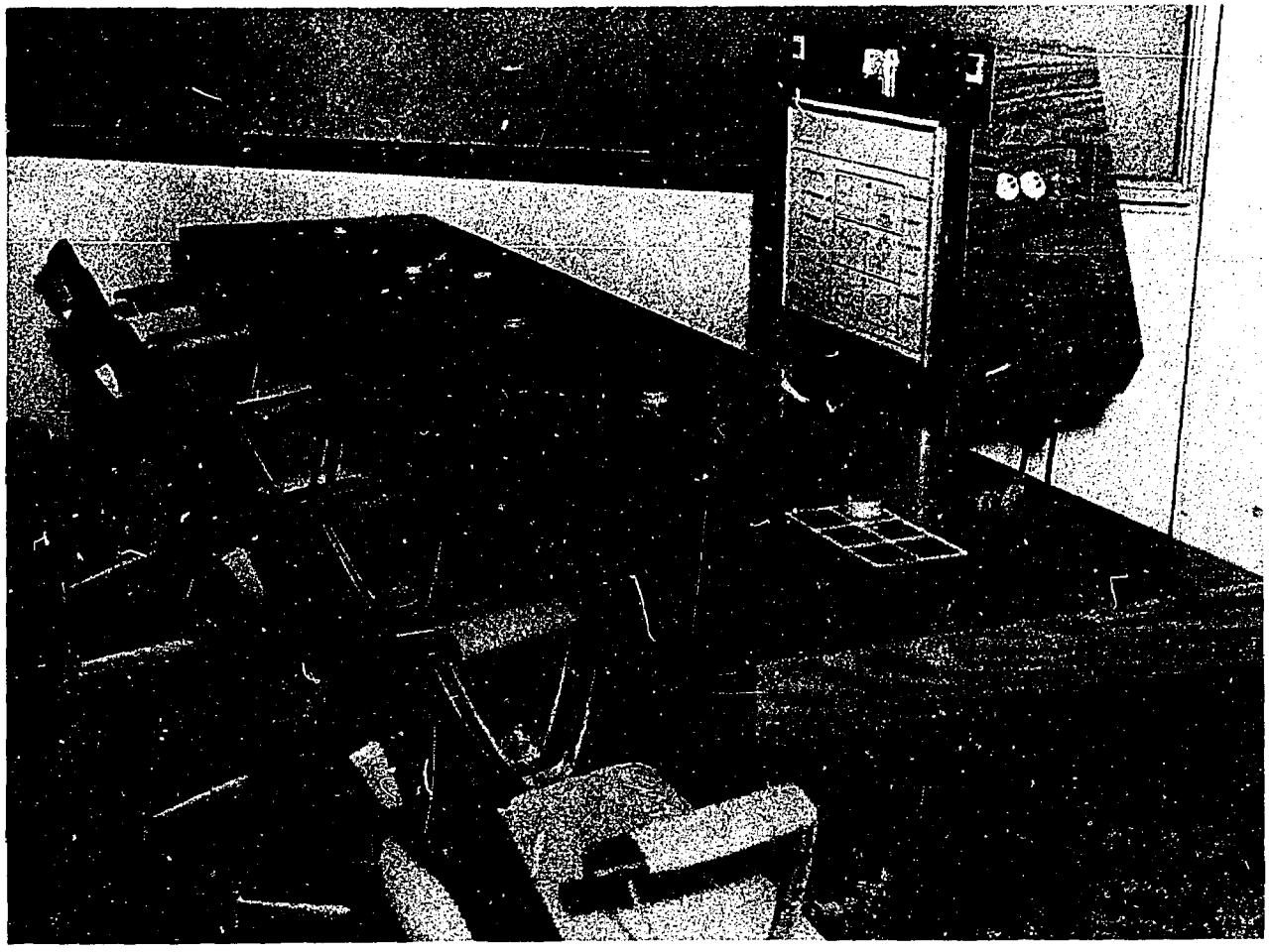
The Human Interaction Research Institute undertook the evaluation in July, 1969. Over a period of six months the evaluator made a number of site visits, interviewed inmates, teachers and prison administrators, and collected available hard data to make some general comparisons between the efficacy of the Lompoc teaching machine program and results in prisons where other educational methods are used. The organization of this report as represented by the Table of Contents indicates the method employed in the evaluation process.

I. INTRODUCTION

The focus of this evaluation will be on providing answers to two questions: (1) Do existing programs when presented by the Allen teaching machine produce (or promise to produce) *acceptable* educational achievements? and, (2) if, indeed, acceptable educational goals can be reached in this way, is the use of the Allen machine practical and feasible in a prison setting, in terms of its impact on teachers, administrators and students and the optimal use of available resources?

There will be no attempt in this evaluation to make general comparisons between teaching methods. First: Although one *teaching* method might be applied to many different kinds of material, the *learning* process is not the same for different kinds of subject matter (beginning arithmetic, for example, as compared with literary criticism); or for different levels within even one academic area (learning the facts of a country's history as compared with understanding the relationship between its political forces); or for students with different backgrounds (whether learning is a review of something already known or whether it is an introduction to the subject); or for different individuals who may learn best in different ways. Various teaching methods are probably adaptable to different learning processes in rather specific ways. If general comparisons among different teaching methods are to be made, which among all of the possible learning situations should be chosen as the general case on which to base definitive comparisons?

Second: If teaching methods are to be compared, any judgment about the superiority of one method over another depends upon the learning goal desired. If (let's say) for a given unit of time one method produced a *minimum* grade gain of .5 in 90% of all students and a *mean* gain of 1.0, while another method produced a *minimum* grade gain of only .2 in 90% of the students but a



mean grade gain of 2.0, which method is superior?

Third: If a valid judgment is to be made about the superiority of one *method* over other methods of teaching given subject matter, it would be necessary to be sure that significantly superior results with that method could be obtained by a wide variety of teachers, and with equated groups of student learners—a very difficult condition to control.

Fourth: In terms of effectiveness, a good film might, for example, be better than a mediocre teacher, while a brilliant teacher might be better than that same film.

We seem limited, therefore, to comparing (for example) the effectiveness of a *particular* chapter (or even paragraph) of a text or workbook with a *particular* classroom teacher (perhaps on a particular day) or with a *particular* educational movie—or a *particular* sequence of programmed items presented by a *particular* teaching machine. There is no practical way to make general comparisons between teaching methods.

II. EDUCATIONAL ACHIEVEMENTS: THE HARD DATA

The performance characteristics of a teaching machine as indicated by hard data (i.e., grade gains per specified unit of time) are really not the performance characteristics of the machine alone but of an entire learning situation in which a machine presents programmed material. Much of the variation in effectiveness is probably due to variations in the quality of the sequences of programmed items. What is thought of as the performance characteristics of a machine may also be a measure of the success of a programmer in arranging the materials to be learned so as to correspond with the natural learning process for that kind of material.

This evaluation generated no new hard data: All of the discussion of grade gains (below) is based upon data that have already been collected at Lompoc and elsewhere. All of the data available are reproduced in Appendix A (along with some lively commentary written by the Lompoc staff). It is important to note that at the present evolutionary state of evaluation components of prison education systems, and given a resulting questionable reliability, the data reviewed herein are probably suggestive, rather than conclusive. (In this regard, and by way of illustration, the Lompoc Education Department has recently switched from the Stanford Achievement Tests, which are inmate-scored, to the California Achievement Tests, which are machine-scored, anticipating an improvement in reliability.) It is very important to remember that reported grade gains are related to specific programs, that is, specific modules containing specific sequences of items. The data do not measure the effectiveness of machine teaching in general, but of specific sequences of items presented in a particular manner by the Allen machines.

The table below relates to the question: "Do existing programs, when presented by the Allen machines, yield satisfactory gains in achievement test scores for given periods of study?" The table (which summarizes a more detailed presentation of the data in Appendix A) reveals that gains range from .8 (in a 20-hour course, Basic Verbal Skills) to 2.4 (in a 13.5-hour course, Basic Number Facts). The overall mean gain for Lompoc inmates is 1.4 grades for 24 hours of study.

TABLE 1

PERFORMANCE CHARACTERISTICS OF LOMPOC PROGRAMS

	Program	Range of Entry Levels	Average Course Time	Average Grade Gain	Number of Modules	Number of Students	Criteria
A.	Basic Verbal Skills	4.0 - 7.0	20 hours	0.6	192	100	SAT math
	Basic Numerical Skills	4.0 - 7.0	30 hours	1.0	222	100	SAT verbal
	(combined)	4.0 - 7.0	25 hours	0.9	414	200	SAT
B.	Basic Verbal Skills +Basic Numerical Skills +Basic Number Facts	4.0 - 7.0	25 hours	1.9	436	67	CAT
C.	Basic Number Facts	4.0 - 7.0	13.5 hours (individual machine)	2.4	22	20	CAT computation
D.	GED Preparation (a preliminary version)	7.0 - 8.9	30 hours	1.8 (77% success in GED)	338	50	SAT median

The following comparisons are not meant to lead to conclusions about the superiority of one method over another. Rather, the comparisons are made in order to judge whether gains made using the Allen machines are *acceptable* if reviewed in terms of a broader frame of reference

based on gains achieved when other educational methods are used with similar populations:

+ After 30 hours of a program, GED Preparation,* 50 Lompoc students made a median SAT gain of 1.8 grades. 77% of these students were successful when they took GED examinations, a rate that compares very favorably with the 65% rate of success among high school seniors, nationally.

+ Donald Butts# estimates that when classroom teaching is used, inmates gain about 1.4 grades in 76 hours—about one-third the rate of gain in the Lompoc machine teaching program.

+ Among 331 inmates in the Draper project** using an individualized learning system of programmed instruction and reinforcing incentives, the average gain after 200 hours of instruction in basic education was 1.4 grades on standardized achievement tests. When students scored a grade level of 9.6 on an achievement test, they were permitted to take the GED tests. Of 75 inmates who attempted to pass the test, 72 (96%) were successful.

+ A general review of the experience of the Manpower Administration Experimental and Demonstration Program## reports that "persons performing at the sixth grade level or above can be given basic education training that will raise them to eighth grade or better, which will then enable them to progress to a high school certificate. However . . . it is extremely difficult to obtain enough improvement in persons performing below the sixth grade at the start to make any difference in their ability to absorb skill training. . . Claims of average gain from basic education training are modest, on the order of about a grade and a half from six months of training."

Against this background of gains typically made when other teaching methods are employed with similar populations, the gains made at Lompoc appear to be at least comparable and are, therefore, entirely acceptable.

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* A nationally-used examination certifying attainment of a level equivalent to high school completion.

\# Supervisor of Education, FCI, Lompoc.

** An experimental and demonstration project for the training of the youthful inmates of the Draper Correctional Center at Elmore, Alabama.

\#\# Judah Drob, "School-to-Work Transition: Some Observations Based on the Experience of the Manpower Administration Experimental and Demonstration Program," paper presented at Princeton Manpower Symposium, May, 1968.

III THE EXISTING EDUCATIONAL PROGRAM AT LOMPOC

Inmate Involvement

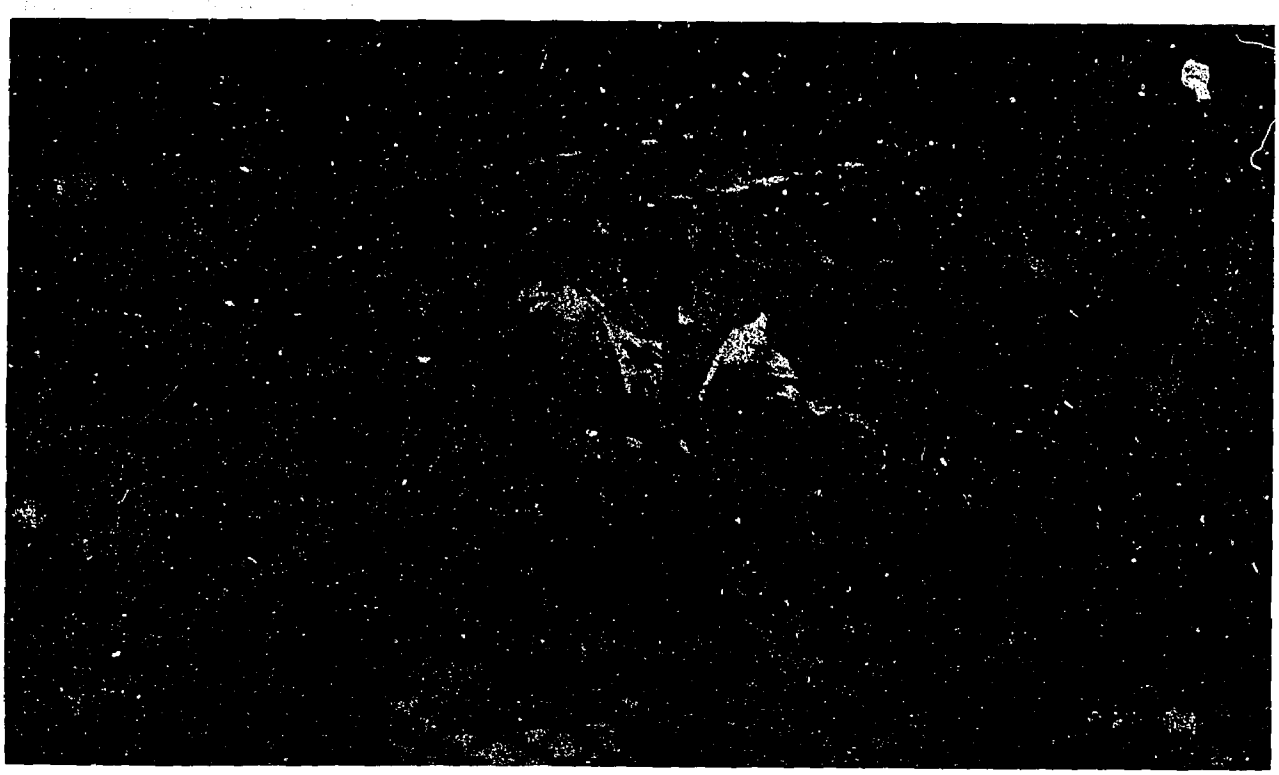
The typical Lompoc inmate is 23.5 years old, stays at Lompoc 15 months, is unskilled or semi-skilled, has completed ten years of schooling, scores at about the eighth grade in the achievement tests, has a record of juvenile arrests, has had prior commitments and is now in prison either for a violation of the National Motor Vehicle Transportation Act or for a narcotics violation.

As Table 2, page 6 shows, of a total typical population of 1,054 inmates (in March, 1969), about one quarter were not involved in any educational program, because they had completed high school. An additional one fifth were not acceptable as candidates for the education program because they were potential deportees for whom no education program was prescribed or were below average intelligence and considered non-educable through existing programs.

Of the 601 inmates (approximately 60% of the total) who *were* in the target population of the Education Department, almost half had as a goal the achievement of a high school diploma or GED certificate, while the remaining half had as a goal achievement of proficiency at an eighth grade level. The average availability of the target group for the education program is one year.

Although 317 inmates were considered candidates for the Basic Skills program during the last school year, there were only 172 enrollees. The difference is accounted for by the high number of non-English speakers and English-speaking illiterates in the Lompoc population which the achievement test did not identify. The discovery that about one third of all inmates who test between the fourth and seventh grade levels on achievement tests are functional illiterates, either because of language problems or educational deficits, has been made only recently. Since May, 1969 the Education Department has been developing a Basic Communications course aimed at bringing illiterates up to a fourth grade level. This program cannot yet be evaluated because it is still being developed and the number of students who have taken it is still very small.

"Education Department Statistics," Appendix B, summarizes inmate participation in the Education Department programs for July 1, 1968 through June 30, 1969. ("High School" courses were offered at night, using classroom teachers from the local school district. The classes consisted mainly of the history and civics courses necessary



for a high school diploma in California after the GED examinations are passed. "College" courses were taken by correspondence.)

Of the 269 inmates who were eligible for the GED Preparation program, 206 participated. The difference is accounted for by the difficulty in teaching that many students with only one instructor available and, therefore, only one group machine in use for the GED program.

TABLE 2

SUMMARY OF EDUCATIONAL NEEDS OF TYPICAL LOMPOC POPULATION

(March 1969)

1054	Total Population
-271	Completed High School or Equivalent
783	
-134	Educationally Deficient but Not Acceptable
649	
-48	IQ Below 89
601	Educationally Deficient Target Population
-15	High School Candidates
586	
-269	GED Candidates
317	Basic Skills Candidates

The Teaching Load

One instructor working full time with one group machine can meaningfully process about 200 students during the period of one year. This figure is based upon a quarter day (1-½ hours) class, a cycle that lasts two weeks (of five days each), a five-man group at any one time and a 14-cycle year. Leave, holidays and other duties which interfere with holding class are accounted for in this estimate.

By contrast, in an ordinary classroom situation, one teacher would see 15 students in each of two three-hour classes for four quarters per year. He would see, therefore, 120 students per year (each of whom should make the same minimum grade gain) for 72 hours of class study time, each.

With the present Lompoc staff, and given the limitations imposed by other duties, a typical school day involves the following participation:

Course	Teachers	# Classes (1-½ hrs)	Total # Students
Basic Communications	2 (part-time)	3	15
Basic Skills	1	4	20
GED Preparation	1	4	20

To satisfy fully the *current* instructional needs at Lompoc, Mr. Butts estimates that the two

present part-time teachers would have to conduct classes instead of performing other duties. If this were done, it would be necessary to add a librarian and a psychometrist.

The Formation of Groups

At the present time, the selection of groups for cycling on the group machines is more of an art than a science. In the vast majority of cases, almost any group of five inmates can work together as long as it is homogeneous in regard to grade level. The staff expected to find students who could not participate together because of personality characteristics or strong racial feelings. With rather rare exceptions, this has not been a problem. Given a superordinate goal of mastering a program, even those with strong prejudices are able to work in mixed racial groups. Perhaps focusing on a common task which takes attention away from racial differences prevents feelings about them from being brought into play. Some of the staff feel that working with group machines in racially mixed groups may be used to help diminish prejudiced attitudes. Lompoc groups are often mixed in a 3 (Caucasian) : 2 (minority) ratio. (Investigating the effects of group participation on prejudice would prove an interesting subject for further study.)

On the other hand, individual sensitivities and reactions to groups appear often enough in the inmate population to take note of. In particular, the staff has observed that the more seriously educationally handicapped (from illiteracy to about the sixth grade) are especially vulnerable to feelings of inadequacy and shame if their deficiencies are exposed. Although on the surface these individuals may seem happy-go-lucky, they very often are not; rather, they feel tormented and humiliated by their inadequacies. These are not individuals who have failed because of borderline intelligence. They tend, rather, to have a *style* of learning that is neither visual nor aural, and they therefore adapt poorly to common school practices which rely heavily on these modes. They have had chronic difficulties in school and bring their resulting sensitivities to school in prison.

One particular variation of this kind of inmate is the individual who has attempted to compensate for his educational deficiencies by appearing tough and developing a "reputation" among other inmates. These men often have acute problems about failing when they work on the machine programs. They are very sensitive to losing status in the group. As one staff member remarked, "The machine is murder on a loud mouth."

To lessen this exaggerated threat of failure, it is particularly important that programs written for the seriously handicapped provide for the highest possible incidence of success.

Another kind of compensatory attitude found among the seriously handicapped is a dominating, demanding tendency. In the Basic Communications courses, for example, there have been a number of occasions when groups have had to be shuffled to accommodate driving personalities who are intolerant of other individuals who learn at a slower rate.

The Lompoc staff is attempting to systematize the process of organizing learning groups. At this stage in their thinking, some dimensions in terms of which group member compatibility might be worked out are:

1. The status of each individual's knowledge of the material.
   (a) Some students once were exposed to the material but did not learn it.
   (b) Other students once knew the material but have forgotten it: present exposure will constitute a review.
   (c) Still another group of students have never been exposed to the material and hence do not know it.
2. The strategies of learning used by different students:
   (a) Some students isolate and concentrate on parts of the material, gambling on being lucky enough to stumble on a solution for the whole.
   (b) Other students have a more holistic strategy and try to keep everything in mind that is not proven to be irrelevant.
3. Differences among students in regard to their "sociality":
   (a) Some students, when they have difficulty, will accept help.
   (b) Other students, when they have difficulty, will not accept help.
   (c) Some students are willing to give help to those having difficulty.
   (d) Other students are not willing to give help to those having difficulty.

The art of forming learning groups (in addition to grade level considerations) is to put together five individuals with the right "mix" in regard to their significant characteristics, which may include these above dimensions.

TABLE 3

TEACHING MACHINE PROGRAMS

Course	No. Hours	Grade Level Progression
BASIC COMMUNICATIONS		Illiteracy
1. A verbal reading program	15	↓
2. Basic numerical facts (in process—planned)	15	↓
3. Writing (in process—planning)		↓ 5.9
		6.0
BASIC SKILLS (when 6.0 in reading) incl. science, geography, language (grammar), vocabulary, spelling, phonics		↓
1. Basic Skills/Verbal	15	↓
2. Basic Skills/Math incl. arithmetic through basic algebra	15	↓ 7.9
		8.0
GED PREPARATION 8.0 qualifies—GED is end measure	25	↓ GED Success

The above table summarizes existing and planned programs. Historically, the Basic Skills programs were the first to be developed and had the goal of developing verbal and mathematical skills to the eighth grade level. The verbal component of the Basic Skills program includes sequences that have science, geography, grammar, vocabulary, spelling and phonics in their contents. The mathematics component includes arithmetic up to basic algebra.

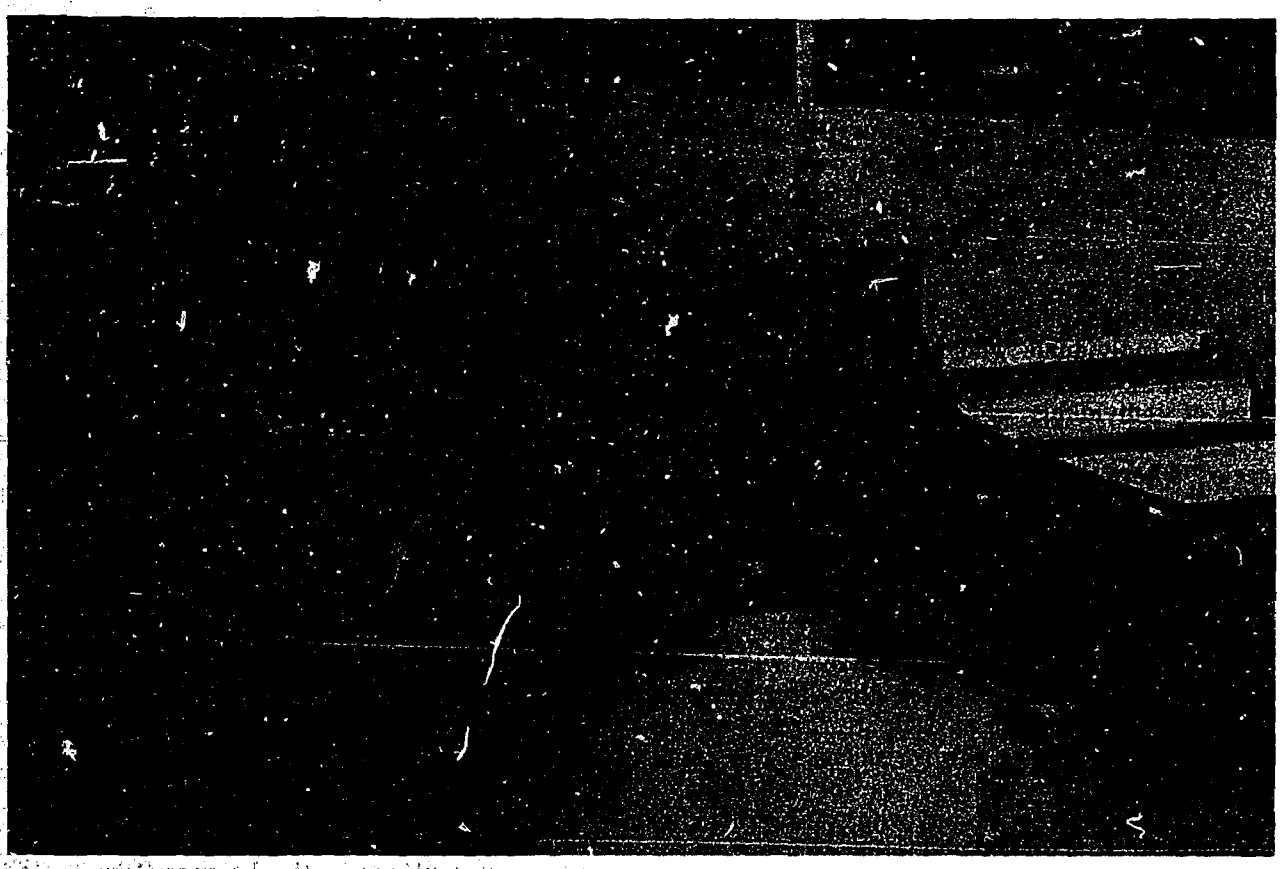
When the student tests at an 8.0 grade level on the California Aptitude Test, he is advanced to a GED Preparation class. The GED program takes the student through modules that concentrate on spelling, vocabulary, social studies, science and literature during the first phase. Sequences for mathematics and grammar are still in the course of preparation. The GED program differs from the others in that students use textbooks much more as resource materials as they go through the programs. When the student has completed the program, he is permitted to take the GED exam. If he fails, he is recycled and takes the GED Preparation program over again. If he succeeds, he can take a few additional units (primarily in American History & Institutions) given by local high school teachers in evening conventional classes, and can qualify for a high school diploma from the local school district.

The Basic Communications course was developed to respond to the needs of the third of the inmates who tested at the sixth grade level but were functional illiterates. Consequently, a program emphasizing the alphabet and phonics and containing simple stories was constructed to develop reading skills from a level of total illiteracy to grade 5.9. (This program has also shown promise in teaching Spanish speakers with at least a fifth grade education how to read English.) A Basic Number Facts program—providing for the rote learning of basic arithmetic operations on a single place machine—was also created. A program to teach writing is still in the process of development. The Basic Number Facts program, when used to supplement the Basic Skills mathematics program (grades 4.0-7.9), is very effective in enhancing gains made in that latter program.

A Typical Education Cycle at Lompoc

Once a new inmate has gone to the Classification Committee and its members have recommended that he participate in the education program, he sees the teacher responsible for the program at his educational level, as indicated by his scores on the California Achievement Test. If the inmate says that he wants to participate in the program, he is put on a waiting list. By volunteering to participate, the inmate signifies that the Education Department has not coerced him; he starts the program with as positive an attitude as possible. There is, of course, indirect pressure exercised by the Parole Board and by the Classification Committee. However, the Education Department maintains a neutral position and limits its responsibility to providing an opportunity for education if the inmate wishes to participate.

As long as an inmate is willing, the Department accepts the responsibility of finding a place for him in the program. Limitations in personnel and problems of timing may prevent his being assigned immediately to a class, but he is put on a waiting list for assignment as soon as possible. The Department claims that it never abandons a



motivated inmate, regardless of his educational level or the success or failure he experiences while he is in the program.

The diagram below represents one of the tag boards by means of which the Department keeps track of its students and insures their orderly progression through the program. The same system is used to cycle students through all three programs: Basic Communications, Basic Skills and GED Preparation.

TABLE 4

TAG-BOARD TO CONTROL MOVEMENT OF STUDENTS INTO AND THROUGH A PROGRAM AND ONTO THE NEXT PROGRAM LEVEL

Time	Waiting	Going	Recycle	Hold	Waiting to Advance	Withdrew	Incomplete
8:00 - 9:30	00000	00000	0	0	0	0	0
10:00 - 11:30	00000	00000					
12:45 - 2:15	00000	00000					
2:30 - 4:30	00000	00000					

The left hand column represents the four times during the day that classes are held with the group machines. Each class lasts an hour and one half. Experimentation with time has demonstrated that students sometimes did not want to leave a class when it lasted only one hour; on the other hand, their interest could easily be maintained for an hour and a half. The quarter-day

system is also convenient in terms of the general institutional schedule.

The teacher in charge makes tentative group assignments for each of the four periods during the day. Each group will begin its own cycle when the group that is presently in cycle (whose tags are placed under "going") has completed. Until then, they are placed in "waiting." At the end of the cycle, the "going" group is tested (either with the California Achievement Test or with the GED Exam). Individuals who qualify advance to the "waiting" list for the next higher course. The tags of individuals who are not qualified to go to the next level are put on the peg under "re-cycle," where they stay until they can be put back into the group under "waiting." The pegs under "hold" are for tags of individuals who are not ready to re-cycle at that time for administrative reasons. The next column of pegs is for tags of individuals who are "waiting to advance" to the next higher level. The column headed "withdrew" is for about 5% of the inmates who, after entering the program, refuse to participate further or are removed for disciplinary reasons. The final column headed "incomplete" is for the tags of men who started a cycle but who were either discharged or transferred to another institution before completing it.

The cycling system, based on the tag-board, insures that individuals progress systematically through the system and are never lost. With both group and individual machines, instructors keep records on which students use the machines at what times and which modules are being employed.

Some students will repeat the same cycle a half a dozen times before they meet the criterion for advancement to the next level. The staff reports that even though students re-cycle and complete the programs, they do not get bored. In fact, some students who are ready for advancement ask to re-cycle—perhaps because they enjoy the experience of success itself. Mr. Allen suggests that some inmates, because of past school experiences of failure, have a need to be "saturated" with success. The teaching machines, which provide for an almost certain experience of success, may thus play a very valuable role in reconditioning these chronically unsuccessful men and provide a basis for building their self-esteem in a socially constructive manner. (A study of this particular consequence of using a teaching machine might be of great interest.)

As long as a man is willing to continue re-cycling until he meets the criterion for advancement, and as long as arrangements with other departments and contingencies of the waiting lists permit, he can continue in the Lompoc School until he receives a GED certificate.

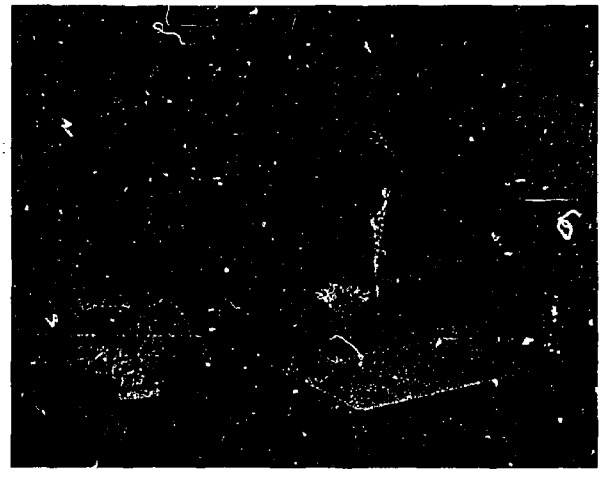
A description of the process of operating a group machine can be found in Appendix C.

IV. THE WRITING OF PROGRAMS

Programming Steps

The programming strategy at Lompoc is not based on any specific theory about the learning process or educational methodology. There is, of course, an underlying assumption that learning can take place when material is presented in a programmed fashion in which items become progressively more difficult, with an ideal increment of difficulty between them. The process of programming at Lompoc is extremely empirical and proceeds by a method of successive approximations (which Mr. Allen calls "naive realism"). The steps are as follows:

1. An area of skills is isolated and a goal for learning is set. For example, one selected goal was to produce an average grade level increase of one year in basic numerical skills, using a 30-hour program.
2. The literature, composed of materials already used in teaching those skills, is surveyed: text books, programmed materials, workbooks, etc., are examined. All promising key notions regarding the teaching of those particular skills are abstracted from that literature.
3. A number of experimental modules*, composed of items invented in accordance with the various theories of teaching the particular skills in question, are created by Mr. Allen, in consultation with the teachers. Gene Kolokowsky# (who is in charge of module design) draws up the items which are then given to the four inmates who work under his supervision, for execution on heavy cardboard.
4. The modules are tried out experimentally on groups of students. Their progress through



* Display cards on which programmed material appears.
\# Academic Instructor, FCI Lompoc.

the item sequences is observed very carefully by the staff. The staff attempts to discriminate between the modules in terms of which among them provide the presentation which best fits the natural learning process of the students.

5. The modules that seem to work best are selected for further development and the others are discarded.
6. The resulting series of modules is fitted together to constitute a first attempt at the program. As groups of students continue to work with the program, teachers continue to watch their progress very carefully, noting the points at which they have difficulty so that the modules can be improved.

Structuring of Curriculum

The curriculum is not divided into subjects, but is structured in accordance with three dimensions used in programming. The isolation and order of contents plays a secondary role in relation to the dimensions of programming. These dimensions are as follows:

1. The levels of abstraction of the material to be presented, which are classified as follows:
   (a) Facts and illustrations represented graphically.
   (b) Rules and examples.
   (c) Concepts and their implications.
   (d) Simulations of situations to which the training is expected to transfer.
2. The emphasis desired. This reflects the programmer's intentions regarding the kind of activity he wishes to demand of the student. The categories of emphasis are as follows:
   (a) Discrimination. The student's primary activity is to tell things apart.
   (b) Recall. The student is expected to repeat material that is presented.
   (c) Problem solving. The student is expected to recognize a deviation from a module that has been presented and to extend the module to include that deviation.
3. The physical manipulation involved, and whether it is involved in doing the program.

In principle, items in a sequence are systematically designed in terms of these dimensions so as to elicit appropriate learning strategies on the part of the students as he interacts with the programmed material.

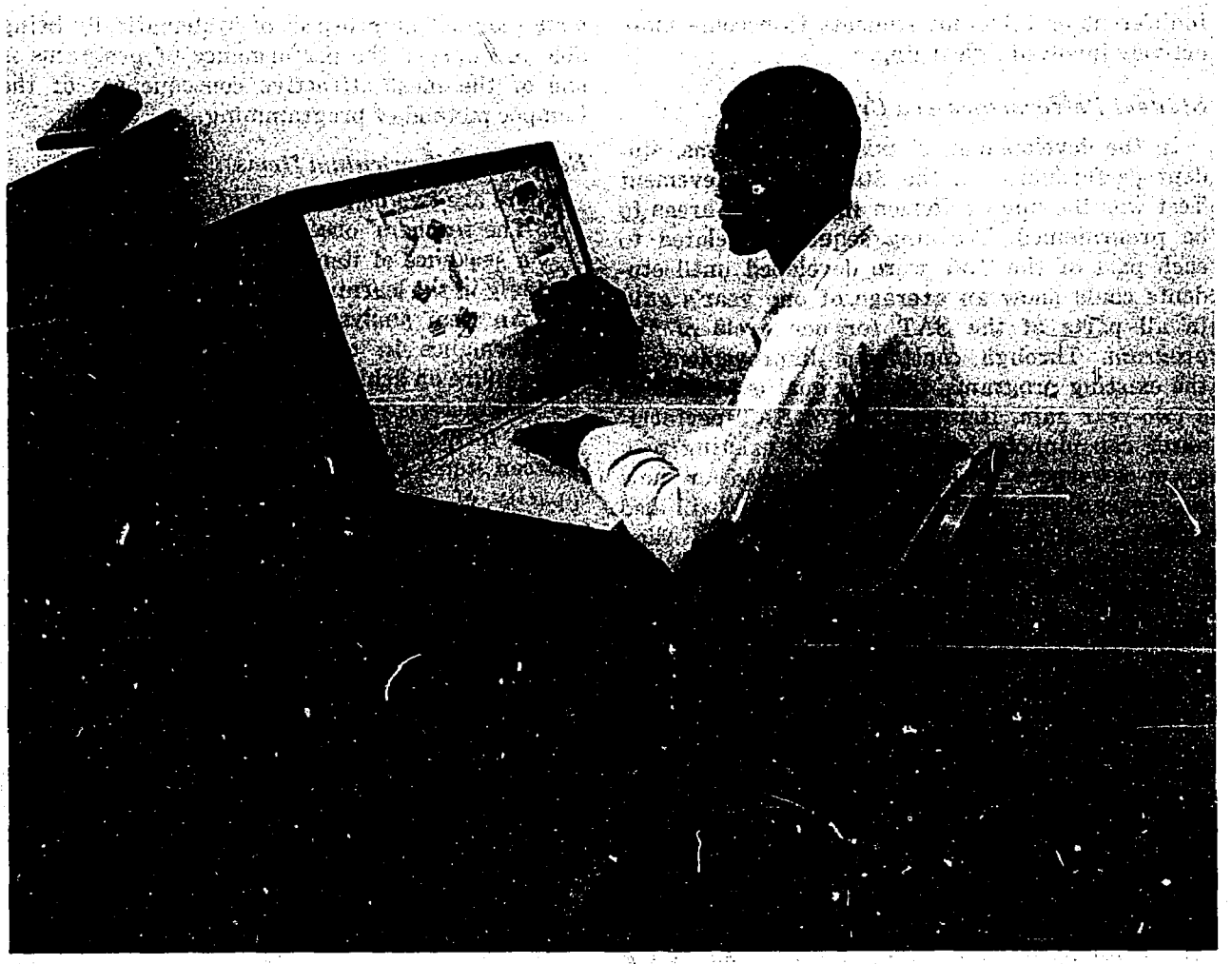
Problem of Redundancy

In designing an effective sequence of items, control of redundancy is a significant problem. To the degree to which a new item contains information that has already been learned, it is redundant. Difficulty varies inversely with redundancy. The problem of the programmer is to make each item in a sequence just difficut enough to produce steady progress without boredom, yet not so difficult that failure on the item will occur. Experience demonstrates that about 50% new information per item is right for the average inmate. The Lompoc group is working towards an operational method for controlling the new information/redundancy ratio.

In general, the strategy for writing a sequence is to make gradual increments with this 50% ratio and then, at the end of the sequence, place an item with much less redundancy, requiring a bigger conceptual step that demands greater use of the student's intuition.

All of the sequences are grouped together into an experimental "course," containing more item sequences than are needed, which is tried out on groups of students. Overly-redundant sequences and those not directly related to the course goals are gradually discarded, while others which relate to achievement test items which the student is not otherwise prepared to deal with, are added. The goal of refinement is to produce a course of 15 hours which maximally prepares the student in areas measured by achievement tests.

According to Mr. Allen, one of the main problems in remedial teaching is the negative attitude held by students towards school, deriving from experience in the regular school system in which students are "taught to respond with panic" when faced with a learning problem. The regular system is particularly painful because, in non-verbal types, "studying" does not produce learning and leads to repeated failure. The student has learned that pain is a necessary part of learning and that he must "try" to remember. "Trying" becomes ritualized and is expressed in postures that publicly express the student's efforts and sincerity. In fact, these gestures take attention away from the events connected directly with what it is that is to be learned. On the other hand, the easy steps in good programmed sequences lead to almost certain success and, therefore, do not elicit pain or demand postures of concentration.



Choice of Individual vs. Group Machine

Whether a program is written for an individual or group machine depends upon the relative advantages of each machine in relation to the material. Given a growing body of experience with both group and individual machines, the educational staff has begun to differentiate the occasions when it is better to use one or the other. The strengths of the individual machine were described in a memorandum dated July 9, 1969 (See Appendix D):

> Its greatest strength lies in the areas of simple discrimination and recall material. Primarily, it is meant to furnish individual practice in various aspects of a task that is best committed to memory prior to further development into more complex concepts, problem-solving activities, or sequenced manipulations. This machine was not meant to be used in shaping complex verbal activity, or long behavioral chains.

The enthusiasm of both teachers and students in regard to the usefulness of the individual machines in committing factual information to memory supports this statement. On the other hand (and to continue quoting from the same document):

> The group machine was designed to complement the individual machine and to handle more sophisticated programs. The essential difference between the two machines is not only the difference between the individual and the group, but is also the fact that the individual machine presents items at random and the group machine presents them in sequence. The two machines should present material on the basis of the division of information into what is generally called "facts and concepts."

The individual machine is best suited to presenting facts. Group machines are best used to present more abstract materials like rules and examples, concepts and implications and situations to which the learned material can be transferred. In addition to these educational factors, social needs should also be considered. Some Lompoc teachers feel that the group experience has a beneficial socializing effect on the inmates and that group pressure often succeeds in influencing

indifferent or reluctant students to become more actively involved in learning.

Student Performance as a Criterion

In the development of existing programs, student performance on the Stanford Achievement Test was the main criterion in choosing areas to be programmed. Teaching sequences related to each part of the SAT were developed until students could show an average of one year's gain in all parts of the SAT for one cycle of the program. Through continuous improvement of the existing programs, the new goal is to achieve a two-year gain. Item analysis of SAT performances can pinpoint areas in which existing program sequences need to be improved or new sequences should be added. This process will also permit discarding superfluous items. Mr. Allen is convinced that improvement in programs will come about from the improvement of existing sequences, not by adding sequences.

In particular, and by way of example, the GED Preparation program does not yet have a well-developed mathematics or grammar section. With the completion of those parts of the program, it seems reasonable to expect an increased average grade gain over the 1.8 that has now been attained.

As another example, the overall average grade gain made by 200 students in a combined Basic Verbal Skills and Basic Numerical Skills program was .9 for 25 hours of study. An analysis of the achievement test performances indicated that deficiencies in basic arithmetic skills depressed the grade gain. A program, Basic Number Facts—consisting of 22 modules which gave instruction and practice on arithmetic manipulation—was devised. When added to the existing Basic Skills programs, an overall increase of one grade gain (to 1.9) resulted. Thus, the improvement of existing programs promises to lead to improvement in results as measured by gains and achievement tests scores. The prospect of systematically being able to improve the performance of programs is one of the most attractive consequences of the Lompoc method of programming.

Evaluating Curriculum Items

There are two basic modes of item evaluation:

1. The teachers' observations of the impact of a sequence of items while students are actually in the learning process, and
2. An item analysis of achievement test performance in order to relate success and failure on achievement test items to program characteristics.

The former kind of analysis permits steps between items to be adjusted to fit the learning capacity of students; steps that are too great produce too much failure and negative reinforcement; steps that are too small produce too much redundancy and boredom. The latter kind of analysis results in the introduction of items and modules in areas which have been neglected in the program—at least, areas that are defined as important measures of achievement by the achievement tests.

In effect, and by way of analogy, giving groups of students an achievement test at the end of a program cycle is like sending a racing car (the program) on a trial run. The builder of the car knows the characteristics of the track (the achievement test) and has a performance goal (a specified gain in grade). When he has the results of his trial run he tinkers with his car (the sequences of items), using hunches about changes that might improve performance. After making the changes, he tests the results of his tinkering against further trial runs. His method is empirical and has an explicit goal which he attempts to reach through a series of progressive approximations. It is not, however, experimental in a formally methodological sense. That is to say, the method does not involve the testing of educational hypotheses.

V. THE EXPERIENCE OF THE STUDENT

Student Preference for Machines

During the second week of October, 1969 the evaluator administered a questionnaire to and conducted a personal interview with a sample of 20 inmates, all of whom had completed at least one program cycle using the Allen teaching machines (see Appendix E). Almost all had been enrolled in the Basic Skills Program. They had all used the group machines. Most had also used the individual machines as part of the Basic Number Facts program or as part of the supportive education segment of vocational training.

Without exception, inmates preferred machines for learning facts by rote. They were surprised at how much they seemed to learn without feeling a great deal of effort and in what seemed to be a very brief period of time:

> At first it seems like you aren't learning anything. But when you take the test, you find that you learned a lot more than you expected.

> I sure seemed to learn fast, considering that I didn't know anything when I came here.

Discovery—the feeling of arriving at an answer oneself—was also frequently experienced as pleasurable. A number of the inmates contrasted the experience of active involvement when working at a machine with the passivity experienced in the ordinary classroom situation:

> When I was a kid, it would have been easier for me if I had had something like this (a teaching machine). A lot of the time I would get tired of listening to the teacher talking. I would daydream. But if you are working with a machine, it's just there and you're finding the answers out for yourself. You don't have someone up there telling you. In a regular classroom they've got you bored and when they start to tell you something, you've already stopped listening.

Whatever the cognitive merits of machine presentation (in terms of the orderly presentation of programmed materials), the most significant and most powerful advantage of the machine (at least for this particular population) appears to be the avoidance of a formal classroom setting that is ordinarily experienced by inmates as highly emotionally charged. According to both students and teachers, an inmate student appears very often to experience an ordinary classroom situation in an emotionally provocative manner, almost regardless of the contents presented by a classroom teacher or the brilliance of the presentation. The student's energies, in a classroom, are not directed to listening and learning, but towards dealing in a basically emotional manner with his teacher, because the teacher is experienced as an authority and because past encounters with conventional classroom teaching were marked by feelings of failure.

For many inmates, to learn from a teacher seems equated with submission; To resist—not to learn—is experienced as gratifying. The style of this conflict with teachers may differ from inmate to inmate: some defy the teacher directly, with belligerence; others bring into play a variety of techniques of passive resistance—talking, smoking in the toilet, wandering in the corridors, sleeping, horseplay, etc. Most experience an ordinary classroom as boring; they daydream and cannot concentrate. All of these manifestations of withdrawal of attention function to disengage the inmate from a situation in which he feels resentment for which he has no direct outlet, but in which he feels trapped by the institution's expectation that he attend and, indirectly, by the pressure of the parole board.

When a teaching machine is used, however, there is no longer a teacher at the front of the class talking at the students, enforcing discipline and obedience, asking questions and expecting answers, specifying what is satisfactory and what is failure, appearing to be a dominant person demanding passivity and conformity on the part of students—in short, doing all of the things that invite his being experienced as an authority. Rather, the role of the teacher becomes benign and benevolent when a machine is used. He participates only when invited—when the students ask him a question. His other activity, the observation of the students while they are in the process of learning, does not intrude upon their emotional life space. He is no longer experienced with hostility. Since the setting for learning is no longer emotionally provocative, the students' energies are no longer bound up in their struggle with authority; they are now free to concentrate on the information being presented by the machine.

Machine teaching also helps inmates avoid the second source of emotional difficulty associated with classroom teaching: the experience of humiliation due to the exposure of ineptitude and ignorance in front of a group. Perhaps for the first time in their lives, many of these inmates are having an educational experience that is relatively without conflict.

Determinants in Preference for Individual vs. Group Machines

Preferences for individual machine or group machine depend partly on educational appropriateness and partly upon individual differences related to inmates' personalities. All who had used the individual machine were enthusiastic about them in learning rote materials—indeed, the basic factual material in any field. Machine presentation is systematic, it enables the student to know what he does not know, it presents the information in a non-threatening context and in a manner that involves the student in a continuously challenging activity. Students who dislike group pressure—to go faster, to go slower, or to accept, passively, the answers being proffered by others—prefer the individual machine. Students who like to feel that they are discovering answers, who cannot tolerate being told, who want to be the first to know something, who cannot tolerate waiting for others and who like to feel that they are figuring things out for themselves, prefer the individual machine. A most impressive phenomenon is students' coming voluntarily to classrooms in order to use the individual machines. Without having to receive any direction or instruction, they select a group of modules, sit down at the machine and proceed to go through the modules at their own pace. One has the feeling that many students take advantage of unused moments to come into the department to use the individual machines.

On the other hand, students who can tolerate depending upon others for help, who enjoy the group interaction and who are able to experience the group as a team competing with the machine ("It's like a group game that holds your attention. You tell everyone, we're halfway through and not to make a mistake now.") prefer the group machine.

Observation of a group of students working at the group machine corroborates the students' subjective reports. They seemed completely absorbed in going through the modules. The machine presented an item, group discussion followed, a decision was made about which answer to choose, the group waited for the machine response. They did not appear to notice when visitors came into the room, talked in the background or left the room. The teacher was ignored except at moments when they directed a question to him. There was no horseplay, no daydreaming, no restlessness. The mood was business-like and serious. Mr. Butts confirmed these observations: in the two years that the machines had been used as the primary educational vehicle, there had not been one disciplinary infraction in the day school. Using the machines has meant the end of almost all disruptive activity.

The inmate questionnaires and interviews also reflected the high level of interest—even enthusiasm—for learning when machines are used: "For history, I'm really wired up. I'm the first one here in the morning!"

The Pro-classroom Attitude

On the other hand, there were a few students who preferred learning in a classroom:

> A machine doesn't let you know who is wrong or why they are wrong.

> They are all right for learning the facts that give you a foundation. But real learning occurs under conditions of discussion and conflict. A machine can't do that.

It is interesting and, perhaps, highly significant to note that those who favored classroom teaching appear to have had more successful educational histories than those who rejected classroom teaching completely and preferred the machines. An obvious explanation is that those who *could* be successful in a classroom (perhaps because they were not as involved in conflicts with authority as the others) had their liking for the classroom reinforced. A more subtle explanation is offered by Mr. Allen: those who learned well and succeeded in the classroom also learned that being a student in a classroom is the way you are *supposed* to learn. These same students appear to become *offended* when they must learn from a machine. They feel it is *immoral* to learn so easily, without pain and without all of the strenuous effort of ordinary memorization and homework. Individuals with strong preferences for machine teaching appeared more often to have long histories of educational failure.

Supplementary Materials

There were some students whose general attitudes were quite favorable toward machine teaching but who had a number of specific criticisms:

> The machine can show you how to do a fraction. But working it is a different story. It doesn't give enough practice.

> We should have a workbook as well as the machine so we could practice.

These complaints appear to come from the more

highly motivated who feel that the present programs are too limited. They do not provide those students enough opportunity to practice or to review. A few others in the GED Preparation program felt that the machine did not adequately cover the range of contents in the books.

These comments and requests are at variance with the experience of the teachers who stated that workbooks and supplementary materials had in the past been available, but were never used. It is not known to what extent either materials in the form of textbooks or programmed workbooks would be used now if they were available nor to what extent these materials are necessary for the particular educational objectives that have been defined. It might be, for example, that more practice exercises are requested not because they are relevant to particular educational objectives or criteria, but because some students enjoy going through programs in order to repeat their pleasurable experience of success. It may very well be that opportunities for enrichment, practice and review will automatically be provided during the course of further program development and expansion. However, if that is not economically practical in terms of the number of inmates who would utilize such opportunities, consideration might be given to providing such opportunities in the form of texts and program workbooks.

In addition to the conducting of 20 inmate interviews in order to determine attitudes towards the Allen teaching machine, a specially constructed semantic differential test was given to 97 inmates. (See Appendix F.)

Semantic Differential Test

Test results indicated no significant differences in inmate attitudes regarding classroom teaching versus group machine teaching. Attitudes towards both methods were not significantly different from one another, nor were they significantly different from a random result. (Random choices would have indicated a neutral attitude.) The absence of significant differences was maintained when the data were analyzed according to grade level of courses studied.

The results of the semantic differential do not correspond with the attitudes the inmates expressed during their individual interviews. Nor do the results of the semantic differential correspond to the observations of teachers and other institutional personnel regarding the apparently favorable inmate reaction to machine teaching. Reasons for this discrepancy are not known.

VI. THE EXPERIENCE OF THE TEACHER

Problems of Classroom Teaching in Prison

Mr. Butts, Mr. Allen and Warden J. B. Bogan all described the job of a classroom teacher in a prison as very difficult: his students are older men with long histories of failure in school; they are very sensitive to having their educational deficiencies revealed in a humiliating manner in a classroom; their motives for going to school in prison are very mixed; they often react negatively to the discipline of the classroom and to the teacher, whom they experience as an authority. Even the best classroom teachers are unable to perform well as teachers in a correctional setting. They can at best develop techniques for surviving, for living with the hostility and rebelliousness they experience in the classroom in order to manage to get through the day.

In general, the Lompoc teachers implied agreement with this assessment: to the extent to which their classes are filled with students who resent them and who rebel at the discipline of the classroom, they feel they are expected to control the uncontrollable and teach the unteachable. To the extent to which this is so (and this evaluator has no way of assessing independently the general experience of the classroom teacher in correctional settings), it is easy to understand one administrator's comment that classroom teaching in a correctional setting becomes a matter of survival. One strategy is for the teacher to become a kind of "nice guy," making what are essentially unprofessional compromises in order to cajole otherwise rebellious inmates into a cooperative mood. While, under those circumstances, the inmates might become cooperative from a disciplinary point of view, the educational compromises are such that standards fall. A minimum is taught and a minimum is learned. While the resulting minimal educational achievements frustrates the classroom teacher because he really would like to do a professional job, he gradually learns to resign himself to lesser achievements in order to survive.

The Changing Role

With regard to the experience of the teacher, the most important change brought about by the introduction of the Allen teaching machines is a marked difference in role. (An objective description of the teacher's new role appears elsewhere in this evaluation.) In brief, when teaching machines are used the teacher no longer is expected to perform the usual functions of a classroom teacher: he no longer plans lessons; he is passive vis-a-vis the presentation of information; he no longer establishes standards for passing and failing; he is no longer cast in the role of disciplinarian; he is no longer "responsible" for the students' learning. Although they are somewhat ambivalent, the Lompoc teachers have in general experienced the change very favorably.*

The teacher's new role is benign and supportive. He neither establishes the criteria for success, nor does he demand that the student work until he achieves success. The definition of the student-machine relationship does that. The necessity for active involvement and participation in going through the modules demands so much of the student's attention that he is likely to become a disciplinary problem. The teacher is so much in the background that he is no longer a figure against whom the student can rebel. The student turns his attention to the material to be learned. As Warden Bogan remarked, "They used to act like a bunch of kids resisting school and throwing spitballs. Even many of those who didn't act up had no interest or motivation and achieved no gain in class. Now (when machines are used), many may not gain a great deal, but even those who don't gain are motivated and are trying and are interested. They have much less difficulty staying in class."

Resistance to the Change

Some Lompoc teachers have experienced difficulty in accepting their new role. If an individual has gone into teaching because, for example, he has liked the experience of being an active performer in front of a class, of being the means by which students are taught, of being personally inventive and giving a virtuoso performance, of being dominant and directly influential, of being in control of a classroom, learning to function adjunctively in relation to a machine will probably be difficult. If a teacher's self-esteem depends upon being able to experience himself in that way, then having to be relatively passive and in the background might easily be experienced as dissatisfying and deflating. (This picture may not

* The interview outline used by the evaluator with the teachers is found in Appendix G.

be so extreme as it sounds; many gifted teachers are in large part gifted performers.)

Even to that group of classroom teachers to which being a performer has never been the most attractive teacher's identity, the primacy of a machine in teaching could well be threatening. After all, if they are no longer expected to prepare lessons, to present material, to keep order or to give grades, what significant function is left to them? Except for the taking of roll and for turning the electricity on, they have been displaced.

Offsetting the Resistance

It appears that Mr. Allen anticipated this problem and, in doing so, has avoided what might otherwise have been a serious crisis and real opposition on the part of teachers. Rather than permitting the classroom teacher to experience a sense of displacement as machines were introduced, he capitalized on the very real advantages machines offer the teacher by creating a new role and a new identity that is functional, valuable, preserves the teacher's self-esteem by providing him with a new set of responsibilities. Although the teacher's role in presenting information is diminished, he still functions as a direct resource to the student in the heuristic process: when students do not understand and cannot explain to one another, they turn to the teacher. He either provides the answer or tells them how to arrive at it. At the same time, he is able to note that the program, at that particular point, may be inadequate since the students cannot make that particular learning step themselves. His most important role, then, is as an observer of the learning process and an evaluator of the effectiveness of the programming. He can bring to a programmer's attention the points at which students appear to have difficulty, and participate in modifying the program so that the difficulty can be overcome. Thus relieved of the ordinary responsibilities of teaching and the pressure of having to create new lesson plans for each day, he becomes an active participant in planning the tactics of learning.

Teacher Evaluation of Effectiveness

It is difficult to evaluate the actual amount of participation or the effectiveness of Lompoc teachers in the programming process. Much of the initial programming and experimentation is done by Mr. Allen himself in cooperation with Mr. Kolokowski and his crew of four inmates who are responsible for the design of modules. However, the opportunity to participate actively in the observation of the learning process and to analyze that process into its component parts should make any teacher more effective. Even teachers who choose to introduce programmed materials using classroom techniques, or who like to supplement programmed materials with classroom presentations and discussions, or, even, who might choose to use programmed materials only to supplement classroom presentations should benefit from the opportunity to observe the learning process under controlled conditions.

The most direct benefit of machine presentation to Lompoc teachers appears to have been removing them from the line of fire in the classroom. Most appreciate no longer being the direct target of inmates' hostilities.

a. Regardless of whether they also like to use classroom techniques along with machine presentation, teachers feel relieved of the onerous task of *having to* present certain kinds of factual material repetitively so that inmates can learn it by rote. In that regard, using individual machines to provide supportive education in vocational training shops was especially appreciated. The instructor in charge of the print shop was particularly enthusiastic. A machine program is used to provide an initial orientation to the rules of the shop, to instruct the new trainee regarding the rules of safety and maintenance, and to provide basic facts about printing, kinds of presses, kinds of type faces, etc. Formerly, this instructor either had to neglect supervising production activities in the shop in order to spend long periods of time with new students or had to neglect new students in order to supervise production and give on-the-job training. Now he does not have to waste his time repeating basic facts that students can learn by rote. He can spend more of his time with students on the job while others can learn the basic facts of printing by themselves. If trainees who are using the individual machines do not understand the program, he explains. This instructor also feels that he has a constant check on what his trainees know; they cannot slip through

the program with gaps in basic factual knowledge. He called the use of individual machines "a great asset." He regretted only that more programs had not been written to satisfy his needs. Parenthetically, in this regard, the Lompoc staff feels that they have been unable to explain adequately to the Bureau of Prisons the necessity for spending time to prepare programmed materials in supportive education. They do not feel free to devote more time because they might be vulnerable to criticism from the Bureau. They have the impression that the Bureau only approves of preparing programs when results can be clearly measured by achievement tests—that is, for academic subjects.

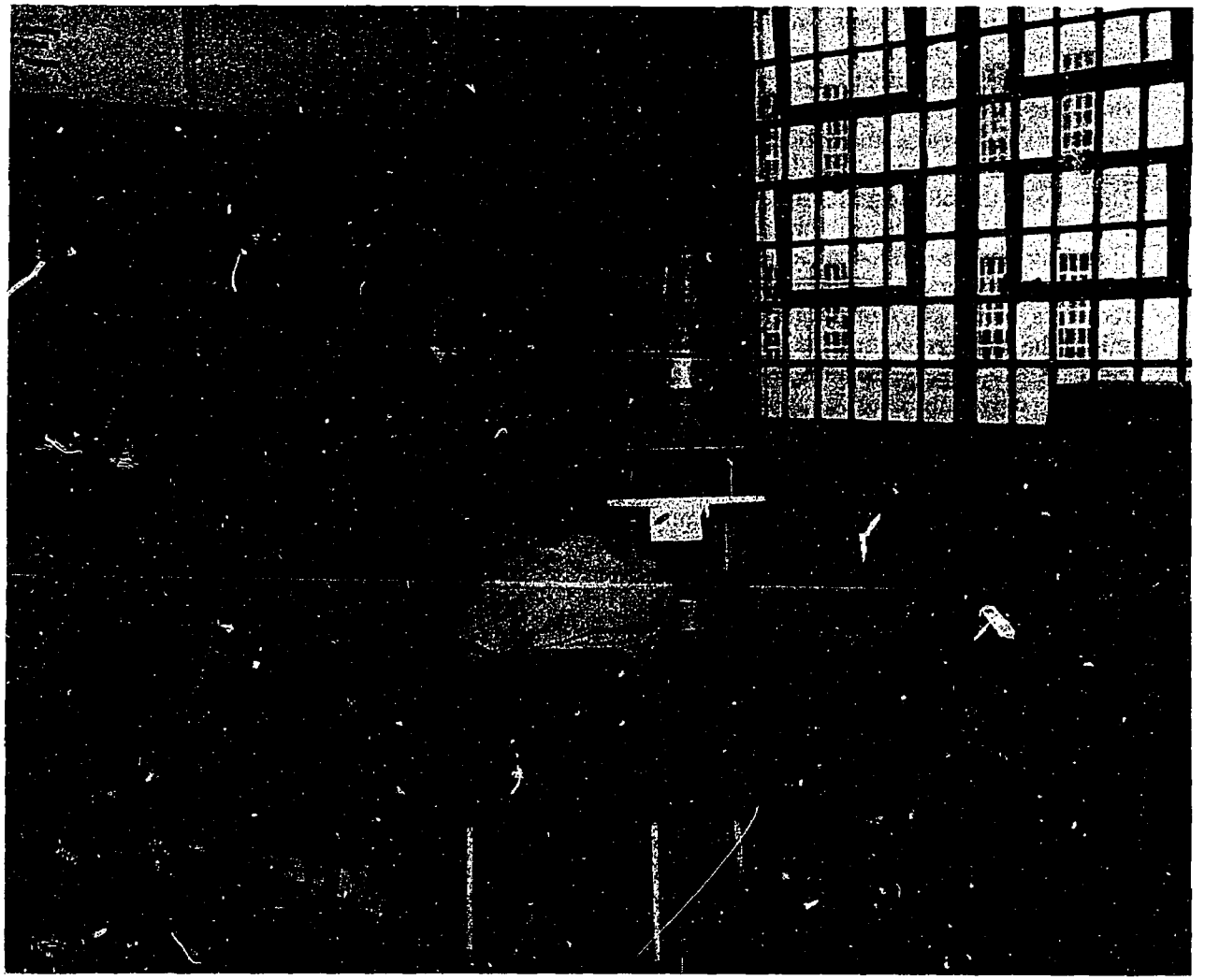
b. The two teachers teaching Basic Communications (grades 0 to 5.9) both agreed that machine presentation is highly effective in basic literacy, phonics, and vocabulary. There are some specific advantages of machine presentation: seriously educationally handicapped students learned best under conditions in which what is to be learned is presented concretely; immediate reinforcement takes place; the experience of discovering by oneself provides important gratification. The teachers also like to participate in the improvement of programs, to insure constant progress and reinforcement to the students.

c. The teacher of the Basic Skills course (grades 6.0 to 7.9) felt that the machine presentation of programmed material was superior to classroom teaching in every respect. He is enthusiastic about the group machine but feels that the addition of the Basic Number Facts program has significantly added to the achievements of students learning the mathematics part of the Basic Skills program. As he put it, "This is not a teaching system. It is a learning system. There is no area in which group machine presentation is less effective than classroom teaching because of the way we learn. Everyone wants to learn. The machine just makes that possible."

d. The teacher of the GED Preparation course feels that group teaching machines are superior to classroom teaching or individual machines when students have an adequate reading background and the subject (such as vocabulary, social studies, and science) is amenable to written presentation. In addition, this teacher felt that the machine was particularly advantageous because slow students do not hold the group up. Since material is systematically presented, sometimes slow students after seeing more material can pick up an idea they previously missed. At any rate, they can always get the help they need from the teacher. The teacher is spared the necessity of repeating material in order to make certain that the slowest students learn while running the risk that the better students will become bored. This teacher's main problem in judging the effectiveness of machine teaching for secondary school level mathematics and language (grammar) was that programs in those areas were not sufficiently developed to make a judgment at this time. This particular teacher has also been interested in teaching non-English speakers to speak English. Most of these inmates are Mexican nationals who will return to Mexico after serving their sentences. Classes are needed to supplement whatever they get out of the Basic Communications course—in order to provide them with practice in English pronunciation. However, there is some reluctance to use the Education Department's resources to teach students who are destined to leave the country as soon as their sentences are served.

The Teaching Machine in Context

In summary, Lompoc teachers are frequently enthusiastic and at least favorably disposed towards the presentation of programmed materials in teaching machines. The particular value of using individual machines to present rote material is universally appreciated. What ambivalence exists in regard to the group machine seems partly related to the incompleteness of programmed courses in some areas and partly to a doubt that machines can replace classroom teaching and discussion where complex explanations are needed, or when students can benefit from discussion. In this regard, however, the teachers may not completely understand the intentions of the Education Department about teaching machines. There is no intent to replace all classroom teaching and discussion with machines. The main problem is to distinguish empirically and methodi-



cally between those educational experiences which are most effective when a teaching machine is the vehicle and those in which classroom teaching or group discussion is the most valuable. This resolves to a question of fact which can be decided only by a process of experimentation and testing using accepted, denotative criteria.

The Experience of Other Lompoc Senior Staff Members

The evaluator had conversations with Warden Bogan, Associate Warden M. R. Hogan, and the Chief of Classification & Parole, Matthew Walsh. Their general attitude towards both individual and group machines was quite favorable. They sense a favorable reaction on the part of the inmates. At other institutions, inmates not infrequently refuse to go to day school. At Lompoc, there appears to be a greater acceptance of school; there is very limited resistance to attending during the day.

There was general agreement that inmates appeared to be more interested and to find more satisfaction when using the machines. Educationally retarded inmates in the older age groups appear to profit greatly. Because they can work by themselves on individual machines and because even group machines make consistent success much more probable, they can participate in an educational program without fear of revealing their ignorance and risking humiliation. Special programs are needed for the total illiterates in the 45 to 55-year-old group because of their very highly charged feelings about revealing their illiteracy.

The youth group, between the ages of 17 and 20, has special problems with school in prison because of difficulties in accepting classroom discipline

and the authority of the classroom teacher. The use of machines avoids provoking these emotional problems, disarms the inmates and creates conditions under which they can learn.

Although there has not been enough systematically observed experience to provide any hard data regarding the beneficial effects of learning in groups (using the group machines) on socialization, these three senior staff members were optimistic in this regard.

All were also in favor of encouraging the use of the Allen machines in other institutions. They felt there would be few drawbacks if a program of innovation were to be conducted with adequate supervision and checks, with systematic observation of the effects of introducing machines at each step—in short, if common sense is used. One danger might be for institutions to become overcommitted prematurely, before they understand how to use the machines properly in their particular context.

Warden Bogan saw a special need for more staff and more training if teaching machines are to be used. He foresaw the need for intelligent and systematic innovative procedures if machines are to be introduced in other institutions. In particular, he felt that cooperative programs with schools of education (such as Lompoc has had with the University of California at Santa Barbara and Allan Hancock Junior College at Santa Maria) can help develop special educational practices that are maximally adapted to penal institutions.

VII. SUMMARY OF REACTIONS TO THE ALLEN SINGLE PLACE MACHINE FROM OTHER INSTITUTIONS

Over a period of about two and a half years, 23 single place machines were distributed by the Bureau of Prisons to 14 institutions. (Group machines are not in use anywhere but at Lompoc.) The individual machines had been manufactured in the prison industries section of McNeil Island Prison from plans prepared by Mr. Allen. Correspondence about difficulties in maintaining the distributed machines (see Appendix H) caused Dr. Garland Wollard to initiate a survey of those institutions in May, 1969, to investigate the nature of those difficulties.

The results of that survey indicated that there had, indeed, been many maintenance problems. Mr. Allen states that most of them stemmed from changes in design that were made at McNeil Island when the machines were put into production. The changes had not been approved by him. The director of the shop producing the machines has since been replaced; Mr. Allen is now confident that his improved communication and mutual understanding with the new director will insure that future production of either individual or group machines will not lead to the difficulties that gave rise to maintenance problems in the past. (See Appendix H, memorandum of May 27.) Several of the May questionnaires regarding maintenance problems were returned with interesting appended remarks reflecting opinions about single place teaching machines in other institutions. Programs in a great variety of areas had or were being prepared for use in these machines:

1. Supportive education in vocational training: programs in tool identification, welding, auto mechanics, blueprint reading, shop measurement, machine identification, industrial safety, upholstery, furniture finishing, production machinery, schematic diagram reading, materials and processes identification, precision measurement, machine shop, auto body repair, and masonry.
2. Remedial education: programs in arithmetic, spelling, English (grammar), and vocabulary.
3. Supplementary education: programs in GED Preparation.
4. Orientation: programs to orient new inmates to institutions.

In general, written comments about teaching and using the individual machines were quite favorable:

> This machine shows promise of being an excellent teaching device.
>
> We find the use of the machine highly motivational with the adult student.
>
> The students at the Youth Center enjoyed using these machines.
>
> It is apparent that the machines can be made useful in many fields such as the vocational program sponsored by industries as well as helping to teach men how to run and repair the various machines in industries.
>
> The teaching machine is a good sound teaching program which helps impart job theory in a quicker and better method than class work.
>
> The Allen teaching machine can be an asset to teaching the basic electricity course only after the programming of many more modules than we have at the present time. It should be noted that the machine can be of immediate value in many other vocational programs where symbols, math problems, machine parts, nomenclature, etc., are being taught.
>
> The student demand far exceeded the availability of one teaching machine.

El Reno used the individual machines to teach remedial reading, mathematics and grammar to students weak in those areas (as measured by SAT scores) *in addition* to their remedial work in classrooms in their school. During a three-month period, ten students both used the teaching machine and attended class while others had only the (same) classroom instruction. Students using the machine increased their SAT's by 1.8 grades as compared with the increase of .9 for those students who did not use the machines.

The most serious problem experienced by these institutions was a lack of enough suitable programmed material. Programmed materials either did not exist in a number of needed areas or were inadequately developed. Teachers at these institutions had neither the experience nor the time to do an adequate job of programming, even though a number had attended a brief training course at Lompoc. Their comments suggest that for materials having general use (i.e., remedial education, GED Preparation, welding codes, tool identification, etc.) programs for general distribution through the prison system might be developed by specialists. For programs that have specialized use (i.e., orientation to a particular institution, programs related to a skill taught at only one institution) additional manpower should be provided at those institutions to develop those programs and make certain that they are well

coordinated with the rest of that institution's system.

Machine presentation of program materials was thought especially useful in institutions (like Terminal Island) in which there is a rapid turnover of inmates. At Terminal Island, for example, a class might begin a semester with 25 inmates and end with only 5, because of transfers to other institutions and discharges. The use of individual machines and individualized instruction, matching the student's needs to relatively brief programs, provides a means for satisfying educational needs under such circumstances.

Ancillary Uses of Teaching Machines in Prisons

The wardens of both Terminal Island and Lompoc expressed interest in designing programs both to orient new employees and as part of in-service training, to keep them continuously informed about institutional policies and changes.

Both wardens mentioned present difficulties in arranging indoctrination and in-service training because of scheduling problems. For each new employee being oriented, several hours of a supervisor's time is required to present factual information that might just as well be programmed for machine presentation. For in-service training, it is very difficult to schedule classes for employees that are part of the operating staff because (especially with the correctional staff) adequate coverage must be insured at all times. However, if in-service training can be programmed, employees can use individual machines on a staggered basis so that too many are not absent from their posts at any one time.

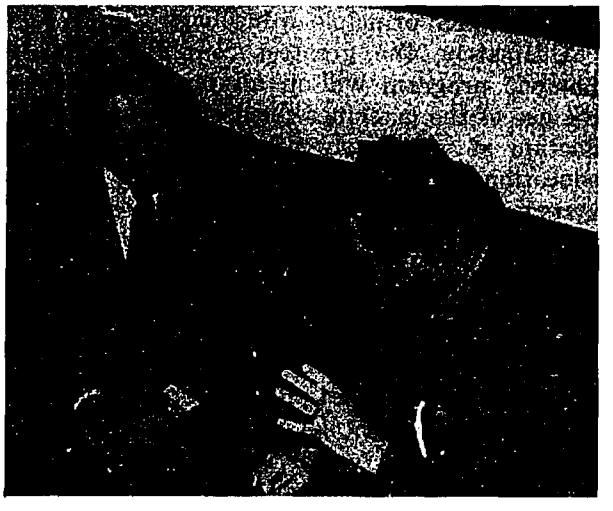
VIII. DISCUSSION, SUMMARY AND RECOMMENDATIONS

Discussion

In general, program evaluations should be made by reviewing program realities in terms of rather specifically denoted goals, criteria or needs. In that regard, this evaluation of the Allen teaching machine presents special difficulties; the goals of prison education programs are implicit rather than explicit, partly because exact formulations relating education to the process of rehabilitation have not yet been developed and partly because educational programs in prisons are still experimental and no one has yet established what is feasible as educational goals. Indeed, one of the most attractive and potentially constructive aspects of the Lompoc program is the stated commitment to develop an education system (the Neomedia Integrated Training System) to provide for the orderly evolution of feasible educational goals, which will be linked to a related experimental development of a whole range of educational vehicles. When properly integrated with one another in the Neomedia Integrated Training System, the combination of devices should maximize the students' potential for reaching those goals. Teaching machines and programmed instruction are merely one component of this projected system.

In the following passages the evaluator is taking the liberty of freely quoting from and paraphrasing statements made by Mr. Allen and Mr. Butts in discussing this proposed system and the place of teaching machines in it*:

> There has never been any intention at Lompoc of building a system of instruction limited to the use of machines only. Machines are only one kind of device in an entire arsenal of potential reinforcement devices that can be adapted to the teaching of inmates. Given certain kinds of material and suitable students, machines are particularly well adapted to the presentation of that material in ways so that learning can be reinforced.
>
> The goal is to devise a systematic approach to the analysis of the requirements of an educational situation—that is, to the analysis of what is to be learned and the range of learning strategies available to a particular population of students—and then to discover, on a highly empirical basis, the best combination of educational techniques and technologies to fulfill the requirements of that situation. The outcome would be *a system of instructional management* in which there has been a systematic matching of educational technology with the requirements of the learning situation. This system would include machines, programmed instruction, traditional classroom techniques, films, discussion groups, audio material, etc., wherever any or all of these is demonstrated on the basis of systematic experimentation to be most helpful.
>
> Experience indicates that, for an inmate population, presenting programmed material by means of a group teaching machine provides a way of sustaining behavior that otherwise cannot be sustained. The attractive elements—the gadgetry, social interaction with a group, the consistent experience of success, the benign role of the teacher—all combine to make it possible for inmate students to learn. Under ordinary classroom circumstances, inmates tend not to learn but to come into conflict with teachers and to present problems of discipline.
>
> A key element is the participation into which machine presentation draws the student. The ten-minute modules present the student with clear-cut, brief tasks that can be completed within a reasonable time span. Immediate reinforcement creates an atmosphere permeated with gratification. As compared with classroom teaching, the atmosphere changes from one of failure or threat of failure to one of success. The student's performance is not a test of him but of the effectiveness of the particular program.
>
> A particular advantage of machine presentation is that it defined the teacher's role as benign for this particular student population. Since he is not responsible for the presentation of material, the giving of grades or the maintenance of discipline, he cannot easily become a symbol of authority against which inmates will frequently pit themselves in either overt or passive rebellion. Disciplinary problems in the Lompoc Education Department are extremely rare. For the same



> reasons, stress on the teacher is markedly reduced. He is no longer expected to teach the unteachable, but is removed from the arena of emotional conflict into which his role in the ordinary classroom thrusts him day after day. He becomes, rather, an observer of the educational process and the means by which educational devices such as programs and program material can be constantly improved. He is no longer forced to cast about each day for a new way to present material to the group of students who will resist his presentation because of their emotional problems. Even a relatively mediocre teacher can be helped to function effectively under such circumstances.

In terms of the overall (implied) goals of education programs in federal prisons, results at Lompoc using the Allen teaching machines appear

* A comprehensive statement by Mr. Butts may be read in Appendix I.

to be quite acceptable. Acceptability is indicated not only by the existing hard data, but by the reactions of teacher, inmates and administrators. Although strict comparability between the Allen machines and other teaching methods such as classroom teaching does not exist, in general, the hard data indicate that the Bureau of Prisons need not fear that in employing the Allen machines it is choosing an inferior method of teaching.

It should be noted, however, that no claims are made by anyone for the general superiority of the Allen machines as a teaching method for all kinds of material. To this point, the range of materials adapted for use in the Allen machines is limited to supportive education in the vocational area, remedial education and preparation for the GED examinations. The Lompoc staff holds the very realistic point of view that the usefulness of teaching machines is something that must be demonstrated for each new kind of material and for each new population through a process of empirical testing. They do *not* propose that the machines be used indiscriminately as a matter of educational principle or ideology.

Ultimately, the greatest contribution of the Lompoc program will in all probability not be the use of the machines themselves but the introduction of an orderly procedure for evaluating educational techniques and devices as part of a system in which machines are only one component. The final judgment comparing the effectiveness of machines for particular kinds of material with other educational methods cannot yet be made *because the existing system does not provide for the necessary comparisons*. However, if the Lompoc system were to be applied to other educational techniques, it might be possible at some future time to determine for particular kinds of material whether one or another of the techniques and devices available provided a superior educational method. One of the most encouraging aspects of the Lompoc courses is that, even now, they are constantly being revised and improved using the everyday experience of students with the programs.

Because the group machine has not yet been produced in quantity, the costs of its production are not known. However, using as a basis for estimate 50 machines, Mr. Allen estimates that the cost of manufacturing each one will be $1,013 (see Appendix J). There have, of course, been costs of developing and building the experimental models. However, these costs were absorbed into the Education Department at Lompoc. The initial costs of any new machines, if amortized over a number of years of its projected operation, should be minimal, per student.

According to the Lompoc staff, the cost to the Bureau of Prisons of running educational programs in which teaching machines are used extensively will primarily be the costs of Teaching Machine Learning Centers that would replace conventional Departments of Education in prisons and, in addition, the cost of establishing a Center for Educational Research and Evaluation at Lompoc.

Mr. Butts has described an appropriate staffing pattern for a typical Teaching Machine Learning Center (see Appendix K) based upon an institution population of about 1,000 and a target population of 600. The pattern describes a system in which students go to class for an hour and a half, five days a week, for two weeks in order to complete any one cycle. (Experience indicates and the Lompoc staff expects that in one cycle of a machine teaching program, an average student should gain 1 to 1.5 grades, the same as an inmate student gains after 72 hours of classroom instruction.) The staffing pattern is also predicated upon minimal waiting lists for recycling or for going on to a next higher academic level.

Mr. Butts has also recommended a staffing pattern for the Educational Development Center at Lompoc, already proposed by the Bureau of Prisons (see Appendix L). A professional staff of three, plus one clerical person and an ancillary inmate staff will evaluate educational innovations in the Lompoc school before they are disseminated to other institutions. The staff will also supervise the writing of new machine programs and the improvement of existing programs. The development of learning centers in other institutions and the training of teachers will be a responsibility of this special group.

Summary

Following are some of the most important questions and related answers around which the results of this evaluation can be organized:

1. Does use of the Allen teaching machines satisfy the educational requirements at Lompoc? All existing hard data indicate that the effectiveness of the machine presentation of program material is at least comparable to that attained when more traditional methods

are used, when the criterion used is gains in achievement test scores.

2. Is use of the Allen machines accepted at Lompoc? Use of the machines seems acceptable at the level of institutional management, teaching staff and students. The machines seem especially suited to remedial education, are very adaptable to the scheduling of institutional life and permit meaningful educational gains to be made even by inmates who are institutionalized for only brief periods of time.
3. Are the costs involved consistent with the resources of the Bureau of Prisons? Using the Lompoc staff as a basis for comparisons, the program using teaching machines does not appear to require any additions to ordinary operating staff. (This assumes that Lompoc's present request for the addition of personnel to do testing and serve as librarian is to make up an existing deficiency, not to add staff because of the machine teaching program.)

   While the building of each group machine will require a capital investment of $1,013, if these machines are reliable and can be used over a number of years, the cost per student should be negligible. Similarly, the cost of duplicating modules photographically should cost no more than twenty-five cents per module.

   The only significant new cost to the system would be those in establishing and maintaining a Center for Educational Research and Evaluation. This center would provide innovative inspiration and a scientific basis for the entire federal prison education system. Whether it would be worth the cost can be established only at some future date when its effects on the existing educational system can be evaluated.
4. What are the risks involved if the Allen group teaching machines were to be disseminated throughout the prison system? There is a possibility that the results at Lompoc are in part the effects of the team's enthusiasm and expertise and cannot be duplicated elsewhere with different staff. Generally favorable responses from other institutions at which individual machines were used suggests that machine teaching is acceptable in prison settings. However, until machines are actually in use elsewhere, there may be some risks in this regard. In particular, other inmate populations—older inmates and more confirmed recidivists—may not take to machine teaching as enthusiastically as the younger inmates at Lompoc. Even if this were so, however, one should at that time ask if anything else worked better.

   There is also some risk that teachers in other institutions might not be sympathetic to the use of machines on an ideological basis. However, the generally favorable reaction of teachers brought to Lompoc for special training to this date implies that resistance to the use of machines will probably not occur, given a careful program of training and dissemination.
5. What are the long-term implications of a broad commitment to the use of the Allen machines? As a general consideration, the Lompoc program is consistent with the general movement in education to the use of programmed materials and educational hardware. In fact, there may be some risk that technological advances using computers to present programmed material might make mechanically operated teaching machines outmoded at some time in the future. However, the educational needs of prison inmates might be so particular that it will never be economically feasible to use more sophisticated methods of presentation in prisons that are widely separated geographically and that have widely different program needs in terms of the characteristics of their inmate populations.

Recommendations

1. The Bureau should proceed with the dissemination of the Allen group machines throughout the prison system. However, it should not do so unless it is also willing to fund the Center for Educational Research and Evaluation (see recommendation 2) which will provide a way for the orderly introduction of the machines into other settings and for insuring that they are used in accordance with practices that have already been developed. While it appears that there are minimal risks involved in introducing machines into other settings like Lompoc, it would be advisable to proceed experi-

mentally and cautiously in settings with significantly different populations.

The problem of dissemination of group machines throughout the federal system should be approached cautiously. Mr. Allen's concept of packaging or "franchising" the machines, the programs and the ways of using them with students is basically sound. However, making innovations in existing organizations is a highly complex process and involves much more than technical changes. It is, in large part, a political process that should be undertaken with respect for existing ideological commitments and personal entrenchments which, if not faced consciously and intelligently, can result in conflict and resistance if not outright subversion.

2. The establishment of a Center for Educational Research and Evaluation at Lompoc should have a high priority. The Center should be responsible not only for the development of new educational devices and methods, but also for the coordination of research into the broader social and psychological implications of those new methods. The Center should also take responsibility for the establishment of uniform practices throughout the educational system and an evaluation procedure as a part of the entire system that will provide the basis for constant improvement in the system.

In order to insure the cooperation between the many individual Education Departments in the federal prison system and the Center for Educational Research and Evaluation, a review and advisory committee made up of representatives from all Education Departments and representatives from the Washington office of the Bureau of Prisons should be formed to work in collaboration with the Center. The consultation of such a committee could facilitate the effectiveness of the work of the Center in making innovations. The committee would help create a feeling of mutuality and participation in the work of the Center throughout all of the institutions on whose cooperation its effectiveness depends. The committee would also legitimize the recommendations of the Center to its target institutions.

While the Center might be located at Lompoc and might use the Lompoc school to test out materials and methods, it should be conceived of as fulfilling a staff (resource) function to the entire system rather than a line (operational) function as part of Lompoc. In that sense, it would be equidistant from all federal institution Education Departments and equally available to all. Administratively, then, the staff would report to the Bureau's Director of Education, while professionally it would develop its role in interplay with the constituents it serves, as represented by the advisory committee.

APPENDIX A

To : Dr. Garland S. Wollard
Director of Education

FCI—Lompoc
DATE: February 25, 1969

FROM : J. B. Bogan, Warden

SUBJECT: Teaching Machines

The following discussion is in reply to your memorandum of February 11, 1969 concerning the above subject.

Reliable information concerning the effectiveness of instruction at Lompoc prior to the introduction of teaching machines is not available. The machines were brought into operation not as an alternative to existing courses, but to fill various vacuums in the system. With the passage of time and with changes and reductions in our staff, the machines gradually came to carry more of the load.

This process was encouraged and direct comparison of the effectiveness of machine instruction with classroom instruction was avoided to reduce conflict that would have retarded the growth of a willingness to accept innovations. The goal was to effect a change in attitude and philosophy. In this, we have partially succeeded. No small effort was made to evaluate our use of machines, but we relied on methods other than direct comparative studies.

The following is a recently completed evaluation of a course entitled "Basic Numerical Skills". Reference is made to modules number 449 through 671 in the booklet "Programmed Material". This set of modules consisting of 2,664 items is the program evaluated.

NUMBER OF STUDENTS COMPLETED:	100
AVERAGE COURSE TIME:	30 Hours
AVERAGE POST TEST GAIN: (S.A.T., Arithmetic Comp., Concepts, and Applic.)	1.354
CRITERIA FOR COURSE ADMISSION: (S.A.T. math score)	4.0 - 7.0
ATTENDANCE SCHEDULE:	1 Hour Per Day For 30 School Days

DISTRIBUTION OF POST TEST GAINS:

GAIN	2.0 YRS.	1.5 YRS.	1.0 YRS.	.5 YRS.	.2 YRS.	No Gain
Arith. Comp.	25%	33%	42%	60%	69%	31%
Arith. Concepts	22%	36%	50%	66%	74%	25%
Arith. Applic.	30%	39%	52%	64%	72%	26%

To understand this evaluation it should be viewed in terms of an engineering goal rather than an excercise in statistical inference. The goal was to produce an average grade level increase of one year for 100 students using a 30 hour program. This goal was selected because it was conceded that it was worth doing, and because it was admitted that no reliable way of accomplishing the goal was available.

To summarize—

1. A goal was selected and defined.
2. What would be accepted as proof that the goal had been met was specified.
3. A program was designed to reach the goal.
4. The process was evaluated as specified.

Although an average grade level increase of 1.0 was achieved, the area of arithmetic computation (to take the worst case) shows that 31% of the students made no gain. At present, 50% of the students gain one year. Our goal for the coming year is to increase this figure to 90%. To accomplish this we have either taken or plan to take the following steps:

Redesign the machine to:

1. Encourage students to respond directly to answers rather than to letters.

2. Allow unlimited time for discussion on Part I with paced discussions on Part II.
3. Accept filmed programs.

Reprogram the modules to:

1. Provide more practice for each concept.
2. Reduce the information contained in center panels.
3. Place all teaching items in Part I, and all testing items in Part II.
4. Furnish more review items.

Replace the S.A.T. with the C.A.T. and employ machine scoring.

Inaugurate a basic reading and phonics program for grade levels under 5.0.

These steps cannot be derived from the statistics. They are based upon observation of student behavior. The machine is valuable because it permits the teacher to objectively observe this behavior while furnishing a stable and repeatable instructional process that is easily amenable to evaluation and manipulation. In the end, we use some simple statistics to see if we have gone where we wanted to go.

It may be that nothing so distinguishes educational research so much as the fruitlessness of its methods. This may be due to a reliance upon statistical inference that leads to repeated validation of many trivial and logically inconsistent hypothesis. This often results when ill-defined, almost unobservable, and frequently unrepeatable conglomerate models are compared with equally nebulous alternatives.

While teaching machines and programs must be compared with available alternatives at each stage of their development, the real superiority of such devices today rests upon an unsupported vision of their potential. A review of the literature at this time would permit almost any conclusion or none at all. But, this vision is the creative step in innovation, and we should not demand that it be proven in order to gain the right to attempt to validate it.

The difference between the conventional classroom and what we are attempting is the distinction between a static system and a dynamic, goal seeking process. The latter is more apt to pay off. Of course, the price of high potential pay off is an increase in uncertainty, and a part of the change we have tried to bring about in the attitudes and philosophy of our staff involves a willingness to accept some risk.

We recommend group teaching machines because within realistic constraints of cost, time, and human resources they provide a means to systematically pursue a variety of educational goals.

The following is an evaluation of a course entitled "Basic Verbal Skills". Reference is made to modules 256 through 448 in the booklet, "Programmed Material".

NUMBER OF STUDENTS COMPLETED: 100
AVERAGE COURSE TIME: 20 Hours
AVERAGE POST TEST GAIN: .794
CRITERIA FOR ADMISSION: S.A.T. Verbal, 4.0 - 7.0

DISTRIBUTION OF POST TEST GAINS:

GAIN	2.0 YRS.	1.5 YRS.	1.0 YRS.	.5 YRS.	.2 YRS.	No Gain
P.M.	16%	24%	37%	49%	61%	38%
S.P.	15%	24%	41%	54%	70%	30%
L.U.	6%	15%	30%	46%	60%	38%

The goal for this course is the same as for Basic Numerical Skills. We have not met that goal. However, the course is not complete. The following program sequences will be added during the year:

PHONICS
STUDY HABITS
WORD ATTACK SKILLS
WORD ANALOGIES
VOCABULARY DEVELOPMENT

We also have a program entitled "Basic Communications". Reference is made to modules 82 through 255 of the booklet, "Programmed Materials". Too few students have completed this course to justify evaluation. While for our own information we evaluate every 25 cases, experience has shown that figures on less than 100 students are unreliable. For now, some students who could not previously read can be observed reading.

In addition to the above, we have a machine GED Preparation Course and have placed individual machines in the drafting class, in the shops, and in FPI. Reference is made to modules 672 through 1010 in the booklet, "Programmed Material".

Modules for individual machines are of a supplemental nature and difficult to evaluate. The GED Prep Course is not completed and will be carefully studied later this year. The following evaluation of the existing GED Prep Course is based upon only 50 cases:

NUMBER OF STUDENTS COMPLETED:	50
AVERAGE COURSE TIME:	30 Hours
AVERAGE POST TEST GAIN:	1.752
CRITERIA FOR ADMISSION:	S.A.T. Median, 7.0 - 8.9

DISTRIBUTION OF POST TEST GAINS:

MEDIAN GAIN	2.0 YRS.	1.5 YRS.	1.0 YRS.	.5 YRS.	.2 YRS.	No Gain
	48%	60%	76%	82%	84%	14%

STUDENTS SUCCESSFULLY COMPLETING THE GED TEST: 77%

The goal for this course was GED success for 90% with 30 hours of instruction. We have not reached this goal, but we probably could do so by raising the criteria for admission to 7.5 or 8.0. However, we will probably retain the existing criteria and expand the course to 40 hours.

Aside from the interests mentioned, the group machine is a media with its own message. Many notions from various group studies probably apply:

1. The group influences its members and sets standards for them including some that are not directly related to the group activity.
2. Deviant members are more likely to accept the standards of model members than vice versa.
3. Any person within the group receives about the same proportion of communication made by each other member.
4. The most satisfactory group seems to be five members. The 2:3 division provides support for minority members; is large enough for stimulation; and small enough for participation and recognition.
5. The group tends to provide members with support, reinforcement, security, encouragement, protection, and rationale.

We might also consider the possibility that experience working with others in a group or team could be of some value in terms of future work success.

Of course, this is not hard data. Unfortunately, a useful hypothesis must postulate additional points for which there must not be any hard data. If hard data were available to support these points, then we could discover only what we already know.

We discussed the construction of group machines with Mr. Minton and advised him that we would be prepared to begin this project in 90 days. We need this time to complete work on the transfer of our programming to film presentation. The production of programs on cards has proven to be a hindrance to progress. This is particularly true when it is desired to constantly upgrade the programs. The change to film will enable us to do most of the programming with a standard typewriter. The resulting acceleration in production will speed up the evolutionary process and allow programmers to converge on meaningful goals in a fraction of the time now required.

In the analysis above we have attempted to provide you with the specific data that you

requested. Assuming there are no objections to our process, we shall proceed with our plans for further refinement of programs and machines to accomplish our goals.

BASIC NUMBER FACTS PROGRAM (Individual Machine)

NUMBER OF STUDENTS COMPLETED:	20
AVERAGE COURSE TIME:	13.5 hours
AVERAGE POST TEST GAIN: (CAT Arithmetic Comp.)	2.4
CRITERIA FOR COURSE ADVANCEMENT: (CAT Math score)	4.0 - 7.0
ATTENDANCE SCHEDULE:	15 hours/day for 9 school days

Gain	3.0	2.0	1.5	1.0	0.5	0.2	No Gain
	40%	60%	70%	90%	95%	100%	0%

LATEST BASIC SKILLS PROGRAM
(Basic Verbal Skills + Basic Numerical Skills + Basic Number Facts)

vs. OLD BASIC SKILLS PROGRAM

NUMBER OF STUDENTS COMPLETED:	67
AVERAGE COURSE TIME:	25 hours
AVERAGE POST TEST GAIN: (CAT Paragraph Meaning or Computation)	1.93
ENTRY CRITERIA:	4.0 - 7.0

DISTRIBUTION OF POST TEST GAINS:

Gain	2.0	1.5	1.0	0.5	0.2	No Gain
	37%	52%	61%	70%	81%	19%
OLD Evaluation* (200 cases)	21%	29%	39%	54%	65%	35%

* See memo of February 25, 1969, Appendix A.

APPENDIX B

EDUCATION DEPARTMENT STATISTICS

F/Y 1969
(July 1, 1968 through June 30, 1969)

PROGRAM	No. of Courses	Enrollments	Drops	Completions	No. of Cert. or Diploma
COLLEGE			17	135	1 (AA Degree)
HIGH SCHOOL	16	1024	200	692	89
BASIC COMM. (0 - 4.0)	1	15	0	15	Classes started May, 1969
BASIC SKILLS (4.0 - 7.0)	1	172	14	158	0
GED PREP. (7.0 - 9.0)	1	206	6	190	142 (GED Cert.)
VOCATIONAL: A/C Sheetmetal	1	100	6	82	82
VOCATIONAL: Auto Mechanics	1	96	7	68	68
VOCATIONAL: Bldg. Trades	1	71	7	40	40
VOCATIONAL: Machine Shop	1	55	14	38	38
VOCATIONAL: Masonry	1	52	9	43	43
VOCATIONAL: Meat Processing	1	36	4	22	22
VOCATIONAL: Welding	1	138	9	105	105
TOTAL VOCATIONAL:	7	548	54	398	398
TOTAL V.T. & ACADEMIC:		2117	291	1588	630

/s/ D. M. BUTTS
Supervisor of Education

APPENDIX C

PRIMARY EVALUATION OF AUTOMATED SMALL GROUP INSTRUCTION SUB-SYSTEM AT LOMPOC

DATE: APRIL 1, 1968

The purpose of this report is to advise your office of what progress we have made in integrating the group instruction machine into our program.

THE MACHINE:

The group instruction device consists of a response console seating five students. Each student commands a decision dial indicating six choices, "A" through "F". This display panel presents information on module cards. Each module card contains two sets of problems, questions or elements of information with six elements of information in each set. The elements of information are indicated one at a time by lights which appear on the module card. The result panel indicates the correctness or incorrectness of each decision. This panel also displays the time allotted to reach a decision and indicates completion of the module upon attainment of the machine's criteria of mastery.

THE INFORMATION MODULE:

The information module consists of twelve elements of information together with whatever additional information the programmer desires. The first six elements are indicated at random until the Part I criteria has met eight successive correct decisions. The second six elements are then presented at random until the Part II criteria has met twelve successive correct decisions.

The Part I elements are indicated one at a time. A correct decision causes the machine to advance to the next element. An incorrect decision results in a penalty with respect to the Part I criteria, but the same element continues to be indicated until responded to correctly.

The Part II elements are indicated in the same way except that an incorrect decision results in a return to Part I. The two parts may be correlated to return to a specific Part I element if desired.

Upon satisfaction of the Part II criteria the module is completed.

MACHINE OPERATION:

The machine presents the group with a problem requiring a decision in a given length of time (variable by the instructor). The group is required to discuss the possible responses shown on the module and arrive at a unanimous decision. They then indicate their decision on the console dials.

The machine indicates that the decision may be incorrect with time to reconsider; is incorrect and they have been penalized; or is correct and they can advance to the next element of information.

The group continues in this fashion until the machine criteria of mastery has been met.

MACHINE PROGRAMMING:

The machine is programmed by an instructor-programmer who supervises the use of the facility.

Initial programming may be intuitive and crude. Upon the completion of a rough program sequence, the instructor begins the first cycle with a group of five students on the basis of assumed needs.

The small group instruction facility consists of the group machine and the instructor's desk fitted with an overhead projector.

Since the initial program is crude, the students will experience a great difficulty in mastering it. At each point of difficulty the instructor will have to intervene and furnish additional explanations and examples. The overhead projector is used for this purpose and a record is kept of all such interventions.

Upon completion of the first cycle the recorded interventions are then programmed and a second cycle begun.

This evolutionary process is continued indefinitely or until a specific behavioral specification has been met.

It is generally desirable to establish a clearly defined behavioral objective prior to the initiation of each program sequence.

Provision should always be made to administer pre and post tests which are either clearly related to the behavioral objective or are themselves the objective.

PROGRAM EVALUATION:

Initial programming efforts may be evaluated in terms of gain between pre and post tests. Evaluation of the entire project, however, should be based upon gain between successive average post test results for groups of five or six cycles. That is, the first five cycles of five students each should be compared with the next five cycles. The amount of gain here will reflect growth of the system.

It must be remembered that initial post gain is a measure of the program and not of the system. In general, the system will do no better than the program and the growth of the program will be dependent upon the ability of the programmer to observe student difficulties clearly, to intervene effectively, and to translate his interventions into sound program modules.

EVALUATION OF INITIAL PROGRAM FOR AUTOMATED SMALL GROUP INSTRUCTION AT LOMPOC

AVERAGE LENGTH OF COURSE:	12 Hours	
TOTAL NUMBER OF STUDENTS:	33 Men	
STANFORD ACHIEVEMENT TEST GAINS:	Paragraph Meaning	.33
	Spelling	.51
	Language	.41
	Arith. Computation	1.02
	Arith. Concepts	.79
	Arith. Applications	1.73

The program began as a basic skills course related closely to the V.T. programs and was later switched to a general remedial program. The bias in the direction of arithmetic and the rather disappointing showing in the other areas is attributable to the fact that, with the exception of arithmetic, very little, of the V.T. programming was transferable with respect to the Stanford Achievement Test.

APPENDIX D

Dr. Garland S. Wollard

FCI - Lompoc
July 9, 1969

Warden Joseph B. Bogan - FCI Lompoc

Driver Education Teaching Machine Program

We are returning under separate cover the driver training program you sent us for review.

Unquestionably, no small effort went into this program, and we hesitate to criticize it.

The program does represent what seems to be an unavoidable phase in the development of all programs. It is too verbose and assumes a large vocabulary, with too few of the concepts involved supported by concrete examples.

A part of the problem may result from putting a little too much pressure on the capabilities of the individual machine—it was designed to deal best with a rather restricted type of instruction. Its greatest strength lies in the areas of simple discrimination and recall material. Primarily it is meant to furnish individual practice in various aspects of a task that are best committed to memory prior to further development into more complex concepts, problem solving activities, or sequenced manipulations. This machine was not meant to be used in shaping complex verbal activity, or long behavioral chains.

The group machine was designed to complement the individual machine and to handle more sophisticated programs. The essential difference between the two machines is not only the difference between the individual and the group, but is also the fact that the individual machine presents items at random and the group machine presents them in sequence. The two machines should present material on the basis of the division of information into what is generally called "facts" and "concepts".

Driving is not a particularly verbal activity and such training might have lent itself readily to a more graphic and simple presentation. The program might have begun with the driver training "facts". This would have consisted of whatever could have been simply illustrated, designated, discriminated and enumerated.

Written driver examinations are, of course, verbal in nature and require reading comprehension and test taking skill. The individual machine is not the best resource in this case, but it is possible to use it to build vocabulary, to present typical test items, based upon the "facts", and to closely simulate the format employed in the actual examination.

We would prefer, based upon general experience, to see information presented in the following order:

1. Facts and illustrations.
2. Rules and examples.
3. Concepts and implications.
4. Maximum simulation of the situation to which the training is expected to transfer.

Also, we would like to have a clear inferential connection between parts I and II of each module. In its most simple form this means teach in part I and test in part II.

Nevertheless, this program is a good performance in the context of our overall advancement into a new technology, and should be commended and encouraged.

Polished programs that are suitable for wide use are not easily produced. The process of production and evaluation must, in fact, be concurrent. We recommend that the driver training program be further developed as follows:

1. A pre and post test be constructed.
2. Prerequisites for the course (especially vocabulary) be established, and a target population specified.
3. Small representative samples of the target population be run through the program, carefully observed, and any weaknesses noted in the program corrected.
4. Average course time and effectiveness be determined (based upon not less than 100 students).

Ideally, any course should specify prerequisites, terminal behavior criteria, time, effectiveness, and cost.

It should be noted that, for our purposes, 100% effectiveness is seldom a desirable goal, because the measure of effectiveness can almost always be increased without improving the program, and without increasing our overall service to the students. Course effectiveness can be increased by raising prerequisites, lowering terminal criteria, or improving the course. Our best goal is to aim at coupling the lowest possible entry criteria and the best possible programs with the highest possible terminal behavior criteria.

Any course claiming 100% effectiveness is probably selecting students rather than training them. Such a course can often be placed on the road to real improvement by reducing either the entry criteria or time, or both, so as to reduce its effectiveness measure to 85%. An increase in the terminal criteria would also be possible.

A modest effectiveness level leaves room for improvements. A 100% effective course need not and by definition can not be improved.

If the effectiveness level is too high, many students who might have succeeded will be deprived of the opportunity to try.

If the effectiveness level is too low, many students will be subjected to avoidable failure.

Finally, program evaluation and development can proceed from two directions. First, we can begin with the program in hand and proceed to find a target population to fit it. Second, we can describe a target population and engineer a program to fit the population. In the first case we run the risk of not finding a target population. In the second case we risk the possibility of never reaching our goals. Here again, to be realistic we must be moderate. A good program will probably result from a mixture of both procedures.

cc:

Supervisor of Education
Assistant Supervisor of Education
Education Specialist

APPENDIX E

QUESTIONNAIRE FOR INMATE RESPONSE

Before you ever were in prison _____

1. How far did you go in school? _____

2. How old were you then?

3. Did you find school hard or easy?

   hard — neither — easy

4. Was school boring or interesting?

   boring — neither — interesting

5. Did you have problems with teachers?

   often — sometimes — never

   About what?

6. Do you feel you learned much?

   much — some — little

   If not much, why not?

7. Were you happy in school?

   happy — neither — unhappy

   If not happy, why not?

8. Did you like your teachers?

   yes — neither — no

   Why or why not?

9. Have you ever been in prison before? yes _____ no _____

10. For how long?

11. Did you go to school there? yes _____ no _____

12. At what grades? _____ What was your goal? _____

13. For how long did you go? _____

14. Did you make progress in grades?

alot — some — none

15. Do you feel you learned much?

alot — some — nothing

16. How was teaching done? Classroom | Programmed Instruction | Teaching Machines | Shop

Describe.

17. Did you find it hard?

hard — neither — easy

18. Was school boring?

boring — neither — interesting

19. Did you have problems with teachers?

often — sometimes — never

About what?

20. Did you like your teachers?

yes — neither — no

Why or why not?

In Lompoc

21. How long have you been at Lompoc? _____

22. How long have you been (or were you) in school? _____

23. What course(s) are you taking? _____

24. What teaching method(s) has been used?

Classroom | Programmed Instruction | Individual Machine | Group Machine | Shop

25. What is your educational goal? _____

26. Do you find school here hard or easy?

hard — neither — easy

27. Is school boring or interesting?

boring — neither — interesting

28. Do you have problems with teachers?

About what?

often — sometimes — never

29. Are you learning much?

much — some — little

30. Compared to learning in a regular classroom, when you use the group machine you learn:

faster — the same — slower

31. Compared to learning in a regular classroom, when you use the group machine you learn:

more — the same — less

32. What teaching methods have you experienced?

Classroom	Programmed Instruction	Individual Machine	Group Machine	Shop

33. Rate them according to which you prefer (1) _____ (2) _____

(3) _____ (4) _____ (5) _____

34. Which type of instructional system would you prefer to see developed more fully for public education?

Classroom	Programmed Instruction	Individual Machine	Group Machine	Shop

APPENDIX F

INSTRUCTIONS

At the top of each page you will see some words. Below the words are a set of scales. Using the scales to show what the words mean to you. Here is how to mark the scales:

(Example)

MY FEELINGS ABOUT A PEACH

In my opinion a PEACH is:

		Ext	Very	Sl	Neither	Sl	Very	Ext	
"extremely sweet"	sour							X	sweet
"extremely sour"	sour	X							sweet
"very sweet"	sour						X		sweet
"very sour"	sour		X						sweet
"slightly sweet"	sour					X			sweet
"slightly sour"	sour			X					sweet
"neither sweet nor sour"	sour				X				sweet

1. Put the X in the middle of the box; do not put the X in-between boxes.
2. Be sure to put an X for every row.
3. Do not put more than one X on any row.
4. Work quickly, but carefully. Do not take a lot of time on any row. Put down what comes to your mind first—but be sure to show what the word really means to you.

Grade reached in regular school

Course at Lompoc

MY FEELINGS ABOUT REGULAR CLASSROOM TEACHING

IN MY OPINION, REGULAR CLASSROOM TEACHING IS:

	Extremely	Very	Sl	Neither	Sl	Very	Extremely	
hot	☐	☐	☐	☐	☐	☐	☐	cold
wise	☐	☐	☐	☐	☐	☐	☐	foolish
cruel	☐	☐	☐	☐	☐	☐	☐	kind
unsuccessful	☐	☐	☐	☐	☐	☐	☐	successful
beautiful	☐	☐	☐	☐	☐	☐	☐	ugly
dark	☐	☐	☐	☐	☐	☐	☐	light
far	☐	☐	☐	☐	☐	☐	☐	near
bad	☐	☐	☐	☐	☐	☐	☐	good
complete	☐	☐	☐	☐	☐	☐	☐	incomplete
dirty	☐	☐	☐	☐	☐	☐	☐	clean
high	☐	☐	☐	☐	☐	☐	☐	low
boring	☐	☐	☐	☐	☐	☐	☐	interesting
wet	☐	☐	☐	☐	☐	☐	☐	dry

MY FEELINGS ABOUT GROUP MACHINE TEACHING

IN MY OPINION, GROUP MACHINE TEACHING IS:

	Extremely	Very	Sl	Neither	Sl	Very	Extremely	
hot	☐	☐	☐	☐	☐	☐	☐	cold
wise	☐	☐	☐	☐	☐	☐	☐	foolish
cruel	☐	☐	☐	☐	☐	☐	☐	kind
unsuccessful	☐	☐	☐	☐	☐	☐	☐	successful
beautiful	☐	☐	☐	☐	☐	☐	☐	ugly
dark	☐	☐	☐	☐	☐	☐	☐	light
far	☐	☐	☐	☐	☐	☐	☐	near
bad	☐	☐	☐	☐	☐	☐	☐	good
complete	☐	☐	☐	☐	☐	☐	☐	incomplete
dirty	☐	☐	☐	☐	☐	☐	☐	clean
high	☐	☐	☐	☐	☐	☐	☐	low
boring	☐	☐	☐	☐	☐	☐	☐	interesting
wet	☐	☐	☐	☐	☐	☐	☐	dry

APPENDIX G

INTERVIEW OUTLINE FOR LOMPOC TEACHERS

Oct. 13, 14 '69

(Use reverse side for answers if more space is needed.)

1. How long have you been using the Allen Group T.M.? _____

   ... the Allen Individual T.M.? _____

   Do you think you can give us an informed and fair opinion about the use of the Allen machine(s)? Yes ___ No ___ Other _____

2. How did you feel when you were first approached about using this system? Why?

3. Was it difficult to learn to teach using a machine?

   very — somewhat — not at all

   What, if any, was the difficulty?

4. How would you describe your new role when you use a group teaching machine?

   How does it differ from your role in classroom teaching?

5. Please rate your job satisfaction (when teaching inmates) using:

   Classroom teaching —

   very satisfying — somewhat satisfying — unsatisfying

   Why?

   Machine teaching —

   very satisfying — somewhat satisfying — unsatisfying

   Why?

6. Describe any changes you have noted in students' desire to learn and work when machines are used. What seems responsible for the change?

7. Describe any changes you have noted in students' attitudes towards the teacher. What seems responsible for the change?

8. What are the differences in effect on students of the individual machines vs. group machines. Under what conditions is each to be preferred?

9. Describe any changes you have noted in students' attitudes towards one another when they use the group machine. What seems responsible for the change?

10. Rate the *general* effectiveness (for learning) of group machine presentation as compared with classroom teaching. Group machine presentation is:

much more effective	somewhat more effective	equally effective	less effective

Please specify in which areas group machine presentation is *more* and/or *less* effective and why you think this is so. Describe desirable and undesirable effects of machine presentation.

11. Are there some areas of content, grade levels, complexity of subject matter, etc. for which each of the following methods is superior or inferior? Describe.

Classroom teaching:

Individual machines:

Group machines:

12. What kind of training would you recommend for regular teachers to help them adapt to this new teaching system? When should this training be done?

13. Please make any other comment that would be helpful to our interim evaluation.

Name _____

Subjects taught at Lompoc _____

Length of time at Lompoc _____

Previous teaching experience _____

Any previous experience with machine teaching? _____

APPENDIX H

Dr. Garland S. Wollard
Director of Education

FCI—Lompoc
May 27, 1969

J. B. Bogan, Warden

Teaching Machines

In view of the maintence problems mentioned in your memorandum of May 9, 1969, and because of complaints we have received about the machines produced by FPI, we recommend that no units of this type be produced in the future.

These machines need not have malfunctioned. They have proven to be a problem because of the failure of FPI to allow for even the most obvious design constraints. We feel that this situation emphasizes the need to more carefully coordinate such projects. It is wasteful to spend a year or two in development of a devise in order to insure its reliability and proper functioning, only to have FPI "second guess" our recommendations in a matter of a few weeks.

In anticipation of the probable production of group machines by FPI, we have been in contact with Mr. Pope, FPI, McNeil Island. He has agreed to produce a prototype to our specifications, to make no modification without consultation with Mr. Allen, and to submit the machine to us for testing prior to production.

We are impressed with Mr. Pope's grasp of the situation and are confident that the problems that have been associated with the individual machines can be avoided.

It is suggested that if any new individual machines are required, they be produced after the group machine project is completed, and that they be designed to use the same programs as the group machine. The design and production of this machine would be based upon the same kind of understanding we have established with Mr. Pope regarding the group machine.

In regard to the implementation of both devises, we are preparing a detailed report outlining our recommendations and will submit it to you in the near future.

cc: Warden
Supervisor of Education
Asst. Suprv. of Educ.
Education Specialist—Mr. Allen

APPENDIX I

GENERAL COMMENTS CONCERNING THE USE OF TEACHING MACHINES AT FCI, LOMPOC

By: D. M. Butts

When I came to this institution in 1963, the educational curriculum consisted of the standard Bureau of Prisons day remedial classes and evening high school classes taught by conventional classroom techniques. The curriculum remained much the same until the first reorganization in 1965 involving the certification of the evening high school program. Soon thereafter, college courses were begun certified by a nearby college. Although the evening programs became certified, the daytime remedial classes staffed by four full-time teachers remained much the same.

Students were assigned on a half day basis to the daytime program by the institution Classification Committees. These students normally ranged from illiterate to 7.0 as tested on the Stanford Achievement Test. The primary goal of the daytime curriculum was to improve grade standing to the highest potential of each student or to raise his grade level sufficiently to be accepted into the certified evening programs. Classes were conducted on an open ended basis—that is, students were assigned to classes continuously by Committee and removed likewise at the discretion of the teacher who determined student achievement. Standard elementary subjects were taught in these classes with each teacher handling instruction in: language arts, vocabulary, spelling, and arithmetic. Some variations were tried such as team teaching with each teacher selecting his strongest subject area together with classroom rotation. Also, attempts were made to individualize the instruction by use of reading kits and programmed instructional materials. However, it was gradually conceded that we were being unsuccessful in accomplishing any significant educational goals with this group. We found the typical remedial student to be disillusioned with public schools when committed. Many were functioning at a low educational level and had developed a "failure syndrome" due to their continual inability to make passing marks in previous educational endeavors. Placing them in our remedial classes only extended their dislike for school because they were experiencing a repetition of their public education. Also, the stigma of being placed in remedial or "slow learner" classes further reinforced their feelings of failure. The teachers often complained that no matter how hard or what they tried, they were usually unsuccessful in motivating this type of student. Experimentation and variation in the conventional classroom seemed to offer no practical solutions. It was not uncommon for me to visit classes and observe the usual signs of classroom boredom.

We first introduced Mr. Allen's individual machines into our vocational related theory classes. We were unable to determine if the sheer novelty effect was bringing about changes in student motivation and learning at that point. The machines were introduced very casually with no pressures placed on the students to use them. Gradually, we found the students asking for more programs on the machines. As these programs were made available, it became obvious that the students preferred the machine instruction over previous conventional presentations. During the summer and fall of 1967, Mr. Allen constructed the first 5-place group machine. In January, 1968 we began replacing the traditional remedial instruction with the machine assisted system. Programs for the machines were still weak, but we decided to start by using an empirical system approach for course construction. We were fortunate in choosing this development method because we soon discovered that some of our preconceived notions about learning and course material actually had little application to this group.

I recall walking into one of the early classes to observe their progress. This particular group happened to be working on geography material and was specifically engaged in locating countries in the Far East. I was amazed to discover these students had absolutely no idea where China was located even when given a map of the Far East. Other interesting and sometimes humorous incidents have happened using this system. On one occasion when a Bureau staff member was observing a group, it was remarked that the men were mispronouncing the word "hyperbolo". Being an educator, it was particularly upsetting for this person to hear the mispronunciation without immediate intervention from the teacher. Eventually, the students found it necessary to ask the

teacher for assistance. At this point, the teacher was able to casually, and without offense, give correct pronunciation to this word. The students returned to the material and correct pronunciation was observable soon afterward. The point I am making here is that the teacher role is no longer one of an authority figure. When the student becomes frustrated with himself or the material, he becomes angry with the machine—not the teacher. They soon learn that they require teacher help in order to progress. For many, it is the first time they have asked for help from a teacher since elementary school. Another important observation is that of student attentiveness and response to the instruction. It is rare to see a student leave for the restroom during the instructional period. It is also rare to observe any signs of usual classroom boredom.

Monetary reinforcement has been used effectively in this program, but mainly as a rationale on the students' part to leave his regular work assignment in order to attend classes. The system provides its own form of reinforcement by informing the students they have successfully completed an instructional module. Many dismiss the failure syndrome and obtain self satisfaction by knowing they are finally succeeding. Also, teamwork is generated among the group which in itself appears to be a rewarding experience.

We have heard much talk in recent months about individualized and programmed instruction. Our system is programmed and is designed to eliminate individual deficiencies, but we do not feel that placing an individual in a study booth and handing him a programmed text will really fulfill educational goals. We like the idea of group instruction and we feel it is more natural to teach our students, especially in a correctional setting, to converse and interact with one another on a given constructive task than to alienate them and perhaps never teach them to get along with others.

I am very enthusiastic about this system mainly because of what I have observed happen in these classes. Frankly, I like what I see developing, particularly the student behavior that is generated by use of this system. The system as it continuously becomes refined, gives promise of becoming more and more adaptable to all types of education. Perhaps, more importantly, it has demonstrated that education does not require expensive and highly sensitive electronic computers to move into a newly structured educational environment. What is needed in the future will be more careful analysis and engineering in replacing our present traditional system to insure a substantial competency level in each American youth.

APPENDIX J

To : Dr. Garland S. Wollard
Director of Education

FCI—Lompoc
DATE: November 17, 1969

FROM : M. R. Hogan, Acting Warden

SUBJECT: Teaching Machines

The following costs are furnished in response to your memorandum dated October 14, 1969.

GROUP MACHINE COST:

Construction of 25 Machines		$25,335.00
Cost per Machine	$1,013.00	

PROGRAM COST:

Cost per Card Module	.25	
15 Hour Course, 200 Cards	50.00	
Twelve, 15 Hour Courses (One Machine)	600.00	
Twelve, 15 Hour Courses (25 Machines)		$15,000.00
TOTAL COST		$40,335.00

ESTIMATED COST PER GRADE LEVEL INCREASE:

(Teacher, machine, and program, but exclusive of Research & Development and normal overhead) $44.00

MACHINE AND PROGRAM COST OF ONE YEAR INCREASE:

(Amortized over three years) $3.00

A conservative view of our experience at Lompoc indicates that one teacher with one machine can obtain a one grade level increase in any applicable subject for 245 students each year.

The cost of $3.00 per grade level increase is reasonable and probably justifies the use of the machine as an instrument of instruction.

However, use of the machine is further justified as a tool of research and as a means for staff improvement. Instruments of instruction can be judged in terms of samples taken of the products of the processes assumed to have produced them.

This is the usual method employed where the actual processes are difficult to observe. However, this evaluative activity seldom results in useful innovation. Evaluation involves comparison of samples of process products and does not necessarily require that the process itself be either observed or observable. Innovation implies the invention of a process specifically for the purpose of producing a particular result or product.

Teaching machines enable us to bring under direct observation many details of the learning process that have in the past been obscure, and provide us a more reliable way of replicating any of the many processes that they can be designed to display.

A devise that permits us to directly observe more of the learning process in greater detail is promising for that reason alone. A teaching machine can provide a microscope for pedagogy through which a vast number of instructional processes can be examined exactly and in detail.

Given a verstatile tool with high resolution, the need for elaborate experimental designs is eliminated. A properly programmed high resolution machine exhibits not only the instructional process and the learning process from a behavioral point of view, but the products of the process as well.

Reliable decisions and predictions, together with their confirmation, can be based upon direct observation. What can be directly observed need not be sampled.

Evaluation can tell us which of two processes is probably more effective, but the evaluation will not have produced either process. In general, evaluation is of little value unless someone has first produced processes worth evaluating. In any event, few non-trivial innovations benefit much from elaborate evaluation. The adoption of the printing press and Arabic numerals was managed without research grants.

In our opinion, it is unrealistic to expect most users to immediately appreciate the machine's value as an instrument for observation and as a tool for innovation. However, we feel that with a strong supportive effort, the average teacher will become increasingly confident and will eventually make real contributions to the system.

We suggest that the machine be viewed as a transitional devise to be used to prepare our staff to play meaningful roles in future developments. This is a long range goal which would benefit greatly from careful planning and coordination.

To best serve this goal we propose that responsibility for coordination of the effort be clearly defined. The Educational Development Center suggested in your memo of February 11, 1969 would be an ideal choice for this function. Further, we see many advantages to centralizing our effort and providing for the smooth development and production of devises in the future.

We would be interested in establishing a new small industry at Lompoc devoted to the production of instructional instruments, aids, and materials. Such a facility would also give us the capability to modify any existing or future commercially available devises or materials specifically for institutional use.

We believe that this industry in close cooperation with an Educational Development Center would both increase our effectiveness and reduce long run costs for observable benefits. It is widely believed that the costs of equipment and materials purchased to date cannot be justified in terms of effective use. If the problem has not been exaggerated the elimination of this waste alone would be well worth the attempt.

For the present, if machines and programs are to be provided in the near future, we have few options. The first 25 machines will have to be produced at McNeil Island, the programs printed at Lompoc, and a procedure for purchasing both developed through your office.

Inasmuch as the devise we offer is not the only promising instrument available and the methods we recommend are only one of many possible approaches to educational problems, we recommend that the purchase of machines and materials be restricted to those institutions where applicability is foreseen and a need clearly expressed.

We also recommend that, for the time being, the classes held by Mr. Allen at Lompoc be continued for the purpose of training staff in the use of the machine and in programming techniques. These classes also serve a useful function by offering an opportunity to others, to experience the process involved in sufficient depth to make a credible decision regarding applicability to their own situations. We think the first and a most important step toward our long range goal must be an effort to correct the tendency to make decisions about text books we have never read, programs we have never worked, tools we have never used, and processes we have never experienced. We need to encourage less sampling and using, and more observing and producing, if we wish to play a less passive role in the ongoing process of educational innovation and change.

APPENDIX K

APPROPRIATE STAFFING FOR TEACHING MACHINE LEARNING CENTERS

1. SUPERVISOR OF EDUCATION—Head of organization; acts in full capacity organizing, planning, and implementing complete range of educational programs.

2. ASSISTANT SUPERVISOR OF EDUCATION—Acts as full assistant to Education Supervisor.

3. REGISTRAR—This position handles enrollments, completions, etc. for certified H.S. and college programs; acts in clerical capacity to Principal and Assistant listed above.

4. CLERK—This position is responsible for data collection and retrieval system including IBM cards sent to Leavenworth and institutional education records.

5. PSYCHOMETRIST—This position is responsible for *all* educational testing including pre and post tests for daytime classes.

6. TEACHER—This teacher handles a daily enrollment of 20 - 30 students ranging in grade level from illiterate to 6.0 as measured on the California Achievement Test. Uses 5-Place Group Teaching Machine with full range of media devices.

7. TEACHER—This teacher handles a daily enrollment of 20 - 30 students ranging in grade level from 6.0 to 8.0 as measured on the C.A.T. This group is normally sub-divided into verbal and numerical instruction using the 5-Place Teaching Machines. Drill work is often accomplished on an individual basis with a singular machine.

8. TEACHER—This teacher handles a daily enrollment of 20 - 30 students ranging in grade level from 8.0 upward. This class uses a 5-Place Group Machine programmed with information geared toward helping the student successfully complete the H.S. GED Test.

9. TEACHER/LIBRARIAN—This position is required in order to provide a material resource and reference center for all members of the inmate population regardless if they are directly or indirectly pursuing an education program. Reference texts, programmed material, audio and visual courses, periodicals, and newspapers are made available in the Resource Center under the supervision and guidance of this position.

10. TEACHER/SUPPORTIVE EDUCATION—This position is responsible for handling daily enrollments from each of the full time vocationally funded shops on a scheduled basis. Curriculum deals with vocationally oriented related subjects (blueprint reading, shop math, drafting, etc.)

NOTE: (1) Above positions do not include part-time salaried positions contracted with High School and College sources.
(2) Vocational and Recreation positions funded under the Education Department are not shown above.

APPENDIX L

To : M. R. Hogan
Associate Warden, (P)

DATE: August 1, 1969

FROM : D. M. Butts, Supervisor of Education

SUBJECT: Comments on Bureau proposal to establish a Center for Educational Research and Evaluation at Lompoc

We were quite pleased and honored to learn that the Bureau had given thought to establishing an Educational Development Center at Lompoc. We agree that such a Center with a competent staff could make important contributions not only in correctional education, but also to educational systems throughout the country.

We would envision this Center operating independently, but in close relationship with the Education Department at Lompoc. Just as most teacher universities operate with a laboratory school near their campus, we would expect the Center to develop, test, and evaluate innovative ideas in the Lompoc institution before these new approaches are implemented in other institutions.

The recommended professional staff of three should be sufficient, but we would also expect at least one clerical position to be added for the office work.

We would expect this team to produce results in other institutions by acting as a team of advisors—actually assisting teachers and administrators in implementing new educational ideas developed by the team. As in the case of private franchise companies that operate by certain "success formulas", this team would enter an institution and work with the staff until the program to be implemented was complete and working successfully before leaving.

In terms of training other staff, both state and federal, some of this could be done by the team at Lompoc. By programming the training on machines the student/teacher ratio should not exceed 10:1. However, if major emphasis of this team is placed on conducting conference level training, then much of their time and effectiveness will be lost producing and implementing new educational systems. If both staff training and experimental educational development is to be given equal importance, we should consider additional staff for the Center.

Actual physical location of the Center could be a problem since our building and office space is limited at this facility. We would prefer to house the Center somewhere on institution grounds away from the main complex. The old barracks building would be the logical choice or the building formerly used by the Social Club. Since this team would be engaged in manual manipulation of educational devices, both electronic and mechanical, and in actual construction of prototype devices, the handling of supplies, tools, and equipment would be facilitated outside our main complex. Also, any conference training could be located close to the project headquarters and in general, produce more advantageous results if conducted away from the main complex. Our only other suggestion at this time concerning location would be in the Administration Building.

We notice in the initial proposal there were no provisions for yearly budgeting in this department. Considering the amount of travel expenses that could be expected by this team plus supplies and materials for the development of experimental systems, we would anticipate a minimum yearly allotment of $20,000.00 for the Center and its activities.

Our final comment at this point would be to delay any firm commitment to reorganize the educational staff until we obtain the results of the evaluation study being conducted by the Human Interaction Research Institute. As you know, this evaluation was purposely contracted with an outside agency to insure an objective study of Mr. Allen's machines and system. Although it will only be an interim evaluation, it seems most logical for us to wait and review the contents of this study before we proceed with any major changes in the structure of our educational system.

84/85

FPI MI—6-15-70-1N-4917