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ABSTRACT

This study surveys the audio-tutorial practices and evaluations at 91 California and 25 other junior colleges in the United States. Seventy of the California colleges indicate they are now or will be using the audio-tutorial method in the near future. A large majority of them indicate that they prepare their materials locally. Many of the colleges use performance objectives in their programs, and emphasize constant student feedback and revision of instructional materials. Most also noted that, while the audio-tutorial method did not relieve much of the teachers' load, it did provide increased opportunities for more individualized, personal contact with the same number of students than did the traditional lecture method. Based on the data received, the following conclusions were among those drawn: (1) despite the large amount of work required for preparation of audio-tutorial instruction, those instructors using it were much more enthusiastic about the method than those who largely used the lecture method; (2) students in the audio-tutorial program do learn more in less time, probably because the courses are oriented more toward student learning than teacher preparation and delivery; (3) students are more enthusiastic after experiencing both lecture and audio-tutorial methods; and (4) instructors are provided with greater opportunities to manage their educational environment, by providing content and curricular restructuring opportunities, and the opportunity to make course materials more relevant. (JO)

Audio-Tutorial Practices

In

CALIFORNIA COMMUNITY COLLEGES

Preliminary Report
July 1970

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AUDIO-TUTORIAL PRACTICES IN CALIFORNIA COMMUNITY COLLEGES

CHAPTER I

INTRODUCTION

The California Junior College Association, in cooperation with the Office of the Chancellor, California Community Colleges, recently (CJCA, 1969) proposed a change in reimbursement procedures to encourage expansion of what they termed coordinated instruction programs. The position paper which these two agencies prepared, titled "Increasing the Effectiveness of Community College Educational Programs Through the Use of Coordinated Instructional Programs", focused on the contemporary problems of the community colleges.

> "As community colleges grow in size and complexity there is a corresponding need for growth in ability to meet individual learning needs of students. The measure of effectiveness of colleges in the future will be determined not so much by program content, as by success in developing instructional techniques which reach out to provide college education for individuals in all walks of life." (1)

The position paper continues to point out the importance of motivation and self-direction in learning to community college students, particularly because of diversity of background. Community college student populations were characterized now and in the foreseeable future as rapidly growing in size, diverse in interest and capability, seeking higher-level employment and educational goals, and needing special instructional services to upgrade individual skills and knowledge. These characteristics are supported in the writings of Cross (1968), Collins (1968), Medsker (1960) and others.

The paper contends prominent educators are saying that a fundamental weakness in higher education today is the almost universal application of the classroom system and the pattern of learning experiences that accompanies it. This pattern is neither comfortable nor highly effective for the community college learner, as it typically involves learning events that are segmented, one-way, transient, message-oriented and not under his control.

The lectures a student attends are normally rigidly scheduled, one-time events that vary a great deal from one class to another; and, unless recorded, have no opportunity for student review.

The lecture has definite uses, but the position paper indicts it as logistically a poor way of transmitting information; and instructionally, not the most effective tool for learning. Experts in learning techniques have come to the conclusion, say these authors, that if instructors devoted less time to disseminating information which can be transmitted more efficiently in other ways, they would increase efficiency and gain time and energy for discourse and for student questions.

In the lecture approach to teaching, it is rarely found that instructional strategies are developed in terms of matching instruction with specific objectives. Too little recognition is given the simple fact that "telling" does not necessarily result in learning, and too little attention is given to the problem of defining what outcomes are actually expected of individual learning activities. Thus, patterns of teacher and learner activity do not reflect a high degree of efficiency.

In colleges the practice of repeating multiple section live lectures intended primarily for conveying factual information is a common example of

of the misuse of instructor time. When replicable instructional episodes utilizing media are used for this type of learning, instructor time is freed for higher level teaching, discussions, evaluation, or for additional instructional development.

In this position paper, CJCA describes coordinated instruction systems as new combinations of modern technology with traditional instruction to increase the effectiveness and efficiency of community college instruction.

Among other components, coordinated instructional systems were deemed to include up-to-date learning methods with elements of group lecture, small group seminars, audio-visual programmed instruction, single concept film loops and individual tutoring under the coordination and evaluation of professional instructors.

In the system proposed, teachers have increased opportunity to meet with small groups and individuals, to up-date course objectives, to evaluate student progress and to improve lecture and demonstration for instruction media presentation.

Instruction emphasis in this system changes from classroom lecture to multiple-learning activities. In it, there is no single pattern of coordinated instruction that will provide optimum learning for all students and all situations. Technology at its best cannot develop machines that will replace teachers. The significance of coordinated instruction systems is not the creation of innovations to change the mode of operation, but rather it is the purpose to improve the instructional process making it more effective and efficient in transmitting knowledge to the multitude of students seeking community college education.

Education, according to these CJCA authors, is basically a human experience, not a technological process. The greatest educational force yet discovered, it notes, is the impact of one person upon another person. The greatest value of technological media is that they can extend and reinforce, but not substitute for, the impact of a master teacher upon his students.

As the delineations and descriptions of the "coordinated instruction system" unfold, it is evident that the audio-tutorial method of Dr. S. N. Postlethwait is such a system, although perhaps not the only one.

The audio-tutorial method stems from an idea applied by Dr. Samuel N. Postlethwait of Purdue University in 1961. Postlethwait termed the method an "integrated experience approach to learning - with emphasis on independent study" which sought to put casual instructor comments on audio tape to assist students in proceeding through laboratory assignments. The instructor prepared, for each laboratory assignment, a tape which instructed the student on necessary steps to proceed, focused his attention on those things the instructor wished to have him focus upon, and commented on some of the events which were unfolding before him in the course of his experiments. During the laboratory experience, the student was directed by the audio-tape through the use of laboratory realia, 35-mm slides, microscope slides, 8-mm film loops, texts, and a prepared laboratory manual. These were "integrated" into a laboratory learning experience. Students used "open" scheduling for laboratory time, and each student could proceed at his own pace through the prepackaged instructional materials for each weekly lab assignment. Students could repeat any portion of the instructional package until he had clearly achieved precisely what the instructor felt it was necessary for him to

achieve. A laboratory assistant (and instructors) were present as resources to further aid any student in need of assistance in working with audio-instructional materials. A more complete description of the Postlethwait method is given in Chapter 2.

Dr. Postlethwait presented his idea with evaluative details of the Purdue operation to participants at a UCLA Conference on the Innovative Junior College on January 4, 1966. Burgess Publishing Company replicated the print materials and Burgess Audio-Tutorial Systems packaged the necessary hardware for the system. At the same conference, Dr. James Popham delivered a paper on terminal performance objectives and a presentation was made by Systems Development Corporation on the feedback principle for systems improvement. Both terminal performance objectives and feedback for system improvement are integral components of the audio-tutorial system. (2)

California community colleges grasped these combined ideas and began, individually, to implement audio-tutorial laboratories and classrooms, generally focusing their presentations on general education biology courses. As the audio-tutorial idea spread across the campuses, it was accepted and extended into other disciplines, at least experimentally. In most fields other than biology, commercially-prepared instructional materials were not available for audio-tutorial method, and local development began. Most colleges initiating an audio-tutorial operation made adjustments to the Postlethwait system to accommodate variations in local student bodies and instructor interests. Some used the equipment packages with local materials, while others simply gathered up equipment and developed their own materials.

The Problem

A number of California community colleges implemented the audio-tutorial method. After a relatively (ca. four years) short period of time, these and other colleges appeared to be considering expansion, extension, or initiation of new or larger audio-tutorial facilities. It was apparent that little evaluation had been made of audio-tutorial use in these colleges. Neither was it known with any precision how many colleges were or would be adopting the method.

The Purpose of the Study

This study was proposed to survey the practices and evaluations of audio-tutorial method as it had been or would be applied in the California community colleges. A number of research questions were posed which were related to operations or evaluations.

The Method for the Study

Each of the California community colleges was contacted by telephone to secure preliminary information on audio-tutorials. A questionnaire was then developed and mailed to each institution to secure more precise data. A copy of the questionnaire is located in Appendix A. On-campus visits were made to selected institutions to observe operations and to discuss audio-tutorials with students, faculty, and administrators.

It was expected that evaluative data relating to audio-tutorials would not be abundant. It was decided to seek information from colleges across the country. Eighteen junior colleges were identified from the literature as institutions which had had a longer period of audio-tutorial operation and a

more extensive application of the method than had many of the California colleges. Responses were solicited from these colleges. Individual colleges of all levels were queried for evaluative data when it was known that the college had made such studies.

Most colleges were able to furnish some evaluative data which it had gathered in the course of operating its own audio-tutorial learning facility. Some colleges could furnish data dealing with a number of the research questions which were posed, while others had investigated only one or two. The intent of the study was to compile and generalize such data.

Many colleges which did not have hard evaluative data did have strong feelings or beliefs about audio-tutorials. Sentiments, attitudes, opinions and casual observations were solicited where hard data was lacking.

The study is based on the use of secondary data - ie, data collected by the various institutions. No attempt was made to generate data expressly for the study. The study sought to composite practices and evaluations from responses, and to clearly differentiate between substantive hard data and subjective soft data.

Responses to the Telephone Survey

Forty-seven of the eighty-nine colleges contacted by telephone indicated they were now using audio-tutorial method, a 52% group. Forty-two (46%) of the colleges were not using audio-tutorial method. Two colleges in temporary facilities and operating limited programs for the first time in 1969-70 were not contacted. Seventy-nine colleges in this group noted they expected to be using audio-tutorial method in the near (three to five year)

future, or 87%. Six colleges (7%) did not expect to be using the method in this period, and another six colleges (7%) did not know whether or not they would initiate audio-tutorials in the next five years.

The formal questionnaire sent to the colleges included a question to allow the colleges to note whether they were using audio-tutorial for regular instruction in one or more courses, for laboratories only, for experimental purposes and development of instructional materials, and whether the college was interested in the method or not. Twenty-seven colleges (30% of the survey, 42% of responses) were using audio-tutorial method for regular courses of instruction. Fifteen colleges (15% of the survey, 23% of responses) were using the method for laboratories only. Twenty-one colleges (23% of the survey, 33% of the responses) were using AT experimentally. Twelve colleges (13% of the survey, 19% of responses) were interested in the method but had no plans for it in the near future. Twenty-seven colleges (30% of the colleges in the survey) did not respond to this question. A total of 79 colleges returned the questionnaire, or 87% of the California Community Colleges.

CHAPTER II

THE POSTLETHWAIT AUDIO-TUTORIAL SYSTEM

Dr. S. N. Postlethwait introduced audio-tutorial presentations to augment instruction in freshman Biology at Purdue University in 1961. (3) His purpose was to maximize educational opportunity for students of diverse backgrounds, levels of ability and skills. This was to be done within the framework of a large, multi-section course. An essential aim of the audio-tutorial was to aid students with poor backgrounds, allowing them an opportunity to keep up with the class by listening to supplementary lectures on tape. Tapes were placed in the Audio-Visual Center Tape Library to broaden options for student listening times. (4) These tapes were essentially lectures, but offered supplementary instruction to the student along with convenience in his listening time, opportunity for self-pacing, and content repetition when necessary for comprehension. A fundamental purpose of Dr. Postlethwait at this point, and which was to be retained, was to seek a means of compensating for individual differences among students. (5) As the semester progressed, it was found that some students did not attend lectures, but rather depended solely upon the supplementary taped lectures - ie, a live lecturer was not required for learning to take place. It was also found to be convenient to ask students listening to the tapes to refer to their texts, laboratory manuals, or living materials on display. The audio-tape thus became the vehicle for integrating the various selected components of the learning experience. Ultimately the student was asked to do experiments from the laboratory in context with the written materials and the tape discussion.

Students reacted favorably to these beginnings, and a special section was established which would receive all instruction by programmed audio tape. The experimental section met with the instructor once a week for a short discussion and quiz. These students took the same examinations given to the conventionally taught group, and performed equally well. Student preference for the new method resulted in restructuring the course to provide maximum student opportunity for independent study. The audio-tutorial method also provided an opportunity to make adjustments for differential student interests, backgrounds, and abilities.

The development of the audio-tutorial program was accelerated in 1962, when enrollment in the Botany course increased from 380 to 480. From its inception, the concept proved valuable in allowing slow and average students an opportunity to absorb course materials through a variety of learning processes and as many senses as necessary, while freeing the rapid learner. The well-grounded and the good reader could proceed as quickly and in as much depth as he desired.

Emphasis was shifted from the instructor activities to student learning. The senior instructor was enabled to use his time with students to motivate, to orient, and to accomplish meaningful teacher-student group and individual contacts. A manual to accompany the tapes was prepared for student use, and by 1963 a complete course on tapes and in manuscript form was available.

Structure of the Audio-Tutorial

Basic to the audio-tutorial approach is definition of the objectives to be achieved by the student, and identification by the instructor of the most appropriate means of achieving these objectives. The system is organized so

that students may proceed at their own pace, filling in gaps in their background information, or omitting portions of the program which have been covered in previous learning circumstances. Postlethwait felt the terms lecture, recitation, and laboratory all tended to place the student in a passive role. The term "study session" was adopted to stress student activity in a learning situation, and a variety of study sessions was developed. The overall term "integrated-experience" indicated that learning situations were multi-faceted and multi-sensory. Taped instructions to students were deliberately keyed to a "personal tutor" approach rather than the more formal approach of traditional lectures. The tape became a programming device used to involve the student in a number of learning activities. Those activities which do not lend themselves to inclusion in the tape are retained in other ways. Guest lecturers, motivating and informational films, oral discussion with other students and teaching personnel, and printed descriptive materials are all integrated by the tape presentations. The learning experiences are presented in an independent study session (ISS), a general assembly session (GAS), a small assembly session (SAS), and a home study session (HSS). In time, the SAS was abandoned, and in its place an integrated quiz session (IQS) was substituted.

The Independent Study Session (ISS)

The independent study session focuses on an audio-tutorial booth in a learning center. Teachers are on duty at these sessions to assist students. The instructor and his assistants thus become one more resource open to student use. The learning center is operated on an "open" or unscheduled basis so that students may enter at their convenience, and may remain in the

ISS as long as necessary for learning the materials developed to help achieve objectives for that session. The ISS engages the student with instruction and information presented by audio tape, and may also utilize specimens, photographs, charts, slides, texts, laboratory manuals, etc. Students are directed to reading, viewing, performing, observing, etc. by taped instructions. The ISS thus includes a variety of materials and learning activities which, by their nature, may be programmed by audio tape. Especially important to the ISS is the inclusion of subject matter and procedures which are likely to be mastered at an unequal rate by many students. The student is aware of the objectives of each ISS, and when he feels he has learned what is expected of him, can proceed to the next item. The student is free to back up the tape and repeat any portions of the ISS necessary for him. Study can be interrupted and re-established by the student according to his own time schedule, or it may be interrupted by him for questions or for discussion of materials with instructors or other students.

The General Assembly Session (GAS)

Students in the audio-tutorial course assemble in large-group session for one hour each week. The instructor in charge of the course directs the study during this session. It includes the giving of general directions, announcements, long movies, guest lectures, problem presentation and solving, etc. Its general purpose is to present subject matter and orient the student to its relationship to the other study sessions he will be engaged in. The GAS is an integrating key in the Postlethwait audio-tutorial approach.

The Small Assembly Session (SAS)

For this session, students were scheduled in a conventional manner for discussion. The student thus met with the same instructor or teaching assistant each week. The weekly quiz was administered during the SAS, most frequently on an informal and oral basis. The performance of each student was evaluated during this session, and constituted a portion of the grading base for the course. Conventional written tests were also administered in the SAS, and housekeeping requirements for the course were satisfied here. No new subject matter was introduced in the small assembly session. Rather, students worked with discussion, diagrams, specimens, models, slides, etc. Field trips, review, data collection, problem analysis, single-concept film viewing, etc., took place in the SAS.

The small assembly session proved relatively fruitless for recitation. The appropriate time to answer questions and discuss problems was at the time they occurred. Questions arising during the course of ISS were not easily deferred by students until their scheduled SAS. Such questions were most easily answered by the instructor on duty in the ISS, and the timing was more appropriate to student learning. The SAS degenerated into a rather superficial discussion between a small number of students and the SAS instructor. Discussion useful to the student was more appropriate to the ISS. The SAS, as it continued, was being used essentially only for the weekly quiz. Oral quizzes were being used in the ISS, and presented a major difficulty in scheduling. The written and oral quiz sessions were combined, and the new session was termed the integrated quiz session, IQS, which is described below.

The Home Study Session (HSS)

In keeping with the use of terminology applied to indicate the active learning role of the student, outside study was included in the home study session. It includes text reading by the individual student, problem solving, reading of outside reprints and articles, study of outlines material, and discussion of subject matter with other students.

The Integrated Quiz Session (IQS)

The most important change in the Postlethwait audio-tutorial system at Purdue was the development of the integrated quiz session. This session is informal, with about eight students meeting for half an hour each week with an instructor. Various items from the ISS are displayed. As items are presented by the instructor to students selected randomly, the student identifies the item, relates it to the instructional objectives of the ISS, and performs the procedure or discussion of the object required by the objective. Student discourses are evaluated by the instructor and become a portion of the course grade base. When the student has completed his focus on the item presented, further discussion is solicited from the other students in the group. These additions are evaluated and points awarded by the instructor to the scores of the students presenting them. All students have a turn at some one of the items from the ISS, but must be prepared to cope with any of them.

Postlethwait emphasizes (6) that the basic purpose of this session is not evaluation; that evaluation is rather incidental to the purpose of IQS. Rather, the IQS makes each student prepare for each item from the ISS as though he were going to be required to teach about it. The student who is presenting in IQS is functioning as a teacher, and is incidentally

reinforcing the learning of the other students in the group. The arrangement gives incentive to the student for excellence in preparation, and exploits the idea that the best way to learn a subject is to teach it.

Students gather before the IQS in spontaneous learning groups to discuss presentations as a prelude to the IQS. These meetings are in the nature of informal seminars initiated by and participated in by students themselves. The IQS further serves as a weekly practical exam. It encourages the student to keep up with the subject matter and the various items from the ISS, and it keeps him aware of the interrelationships of the various sessions and the programming of their learning experiences. Peer language clarifies content and concepts for numbers of students. Instructors, through the IQS, quickly identify students who are falling behind or who need special assistance. The IQS also provides a direct and immediate feedback to the instructors, and ineffectively constructed portions of the program are identified. Student analysis or student presentations provide clues for restructuring the program.

Philosophic Basis of the Audio-Tutorial System

Basic to the audio-tutorial system is the belief that learning is an activity done by an individual and not something done to an individual. (7) Postlethwait et al (1969) decided that the structuring of an educational system should be done on the basis that the program must involve the learner. The teacher can best serve the student by creating a circumstance or an environment conducive to learning by providing the direction, facilities, and motivation to the individual learner. The program must allow for individual differences in interests, capacities, and backgrounds. Postlethwait et al (1964) (8) stresses that effective teaching increases these differences

between students.

Conventional lecture-laboratory-recitation instructional approaches restrict the student. He is not at liberty to pursue a topic to the depth he desires, but is limited to the depth presented in the lecture at the time of its delivery. He does not have the option of tuning out those things which he already knows and concentrating on those things which he needs to learn. He is not at liberty to study the subject at times of his own choosing, but at times delineated by the instructor and the registrar. The audio-tutorial system provides options to these limitations, and at the same time involves the student in his own learning. He is an active, rather than a passive, participant in the learning process.

An additional consideration in the initiation of the audio-tutorial method was to afford the instructor the opportunity to critically examine the program he had prepared to facilitate student learning. With the use of instructional performance objectives, the instructor could determine if components he had selected for the learning circumstance were indeed contributing to student learning. Information display was facilitated, placing repetitious activities into media designed to accommodate easy repetition without tiring the instructor or boring the student. The teacher was thus freed from information dispensing, to spend his time in more challenging and stimulating aspects of the teaching-learning process. (9)

Since "learning is done by the learner" (10) it is logical to involve the learner in the process. The ISS is operated on an unscheduled basis, thus giving the student an option of choosing <u>when</u> he wishes to study a subject. Emphasis is placed on learning rather than on the length of time

spent in study. The student is free to alter his study time according to the needs presented by other responsibilities. Postlethwait found (Postlethwait et al, 1969) that 98% of the students favor unscheduled rather than scheduled approaches to the independent study session.

Students required to answer questions performed better on test questions than those whose answers were not required. (11) The ISS not only orients the student to this answering requirement of the IQS, it provides him with immediate knowledge of results.

Postlethwait is not concerned that students appear not to learn more by the audio-tutorial method. (12) He did not anticipate that students would learn more, but that they would learn as much as by conventional instruction. Rather, he was more concerned with the potential for saving time and space, and with the adjustment of the learning circumstance to accommodate individual differences. Postlethwait, who had instructed his course in two conventional laboratories, was enabled through the use of audio-tutorial to return to the university the space required for one of those laboratories.(13)

Because there was a saving in time and space, Postlethwait was encouraged to further pursue the system. This pursuit resulted in a total re-examination of content, procedures, sequencing, materials, environment, attitude, and other ingredients in the learning process. He notes (14) that only after this decision to critical self-analysis was there a significant improvement in student learning.

Beginning with the premise that both the teacher and the student should be involved in learning, Postlethwait set about to restructure the course to this end. The audio-tutorial thus evolved with the following teaching and

learning components from the Postlethwait philosophy: (15)

1. Repetition. There is little question but that the nature of many objectives require repetition for their achievement. However, repetition ought to be engaged in in an intelligent fashion and adapted to the individual needs of a particular student. In a course with 500 students the teacher cannot possibly make the adjustments in repetition for individual student needs. Only the student can determine intelligently how much repetition is necessary.

2. Concentration. Most classrooms are not organized to permit students to concentrate during their study. Students are distracting to one another and other disassociated events which may be occurring tend to distract the student's attention from the subject at hand. The audio-tutorial system permits the student to isolate himself from the surrounding environment by covering his ears with the earphones and by the use of other media to reduce his awareness to his surroundings.

3. Association. In a study of plant science the major objective is to learn about plants. It makes sense therefore, that a study of plants should be conducted where plants are available for observation. Diagrams, charts, models, photographs, and other such devices should be a "means to the end" so that student's attention is directed to the literal plant itself. The audio-tutorial system provides an opportunity for the student to have an object available at the time he reads about it, does experiments, etc.

4. Appropriate sized units of subject matter. People vary considerably in the amount of subject matter that can be grasped in a given amount of time. Programmers have demonstrated that most people can learn almost anything if it is broken into small enough units and the student can take time to become informed about each unit before proceeding to the next. Any program of study therefore should provide each student an opportunity to adjust the size of the unit to his own ability to assimilate the information, so that those who can absorb large quantities of information may do so in an unrestricted fashion, whereas others who must proceed more slowly are permitted to do so. The audio-tutorial system allows the student to proceed at his own pace and to break the subject matter into units commensurate with his ability.

5. Adapt the nature of the communication vehicle to the nature of the objective. It is logical that no simple vehicle such as lecturing or a textbook can achieve the full spectrum of

objectives for a complex subject. The student's experiences should not be confined to any particular vehicle as film, audio tape, text book, or a lecture. In cases where the development of a procedural skill is necessary, there is no substitute for the student doing this procedure himself. A properly structured course, therefore, would carefully define objectives and not try to mold objectives to fit a favorite medium (lecture, for example) but instead would use the medium best adapted to the nature of the objective.

6. The use of multi-media. Individuals differ in their responsiveness to different kinds of communication devices. Some people learn well through reading, some can learn best by auditory communication, and others can learn best by literally handling specimens and performing experiments. The audio-tutorial system thus provides an opportunity for subject matter to be covered in a great variety of ways with the student exploiting the medium which communicates most directly and effectively for him.

7. Finally, and most important, the integration of learning activities and situations. It stands to reason that if learning events are to be complementary and to have some relationship, they should be brought into close proximity and properly sequenced. The conventional structuring of a lecture, recitation, and laboratory does not take this into consideration but rather may expose a student on Monday to a lecture concerning a given subject; perhaps on Wednesday the student does experiments related to that subject; on Friday a recitation will involve the student in some exposure to the subject; and then on Sunday night, late, the student may read on this subject from text. The audio-tutorial system permits the student to bring all of these learning experiences into an integrated sequence so that each learning event may enhance or complement the adjacent ones and thus result in a synergistic effect. One might compare this analogously to an orchestra. Many musical instruments making sounds in a random fashion, result in noise or cacaphony; however, these same sounds, if given timing and placed in an appropriate sequence or relationship one to another form a melody. I am suggesting that there is a melody of learning and that teaching is, indeed, an art. It is the art of sequencing learning events into a meaningful experience for students.

As the audio-tutorial developed along these lines, it became apparent that independent study was an essential key to the system. It was equally clear to Postlethwait (16) that even the most capable teacher could not

create a program so effective that all students would be able to complete all learning activities unassisted. But a capable teacher could provide a basically adequate program, although there might be an infinite number of points in a given program where one or more students might have difficulty. The decision was therefore made to provide a basic program, and to have, as in a conventional laboratory, an instructor circulating in the laboratory among students. This instructor could quickly determine and respond to the needs of individual students in mastering program content.

Increasing enrollment made the additional instructor possible. It was calculated that the same staff, adapted to the audio-tutorial approach, could serve a larger number of students. By converting one existing laboratory to an audio-tutorial learning center, no additional space was required. The same staff could keep the Learning Center open from 7:30 a.m. to 10:30 p.m. Monday through Friday. Twenty-two audio-tutorial booths and twenty-two sets of AT materials would serve 380 students. For demonstrations, one or two pieces of equipment were adequate to serve the entire group.

Changes in the Postlethwait System

The ISS has remained much the same in principle, but its manner of implementation and content has changed. It is now conducted in a Learning Center with 32 stations to accommodate larger numbers of students. Behavioral objectives are prepared for each week's program, and these are distributed to students.

Taped materials have been deemed critical to the system. Postlethwait comments in this regard: (18)

> I have been amazed, and in some cases dismayed, at the significance of some items or activities which to me appeared trivial but in fact prove to be of great consequence in student achievement. The sheer proximity of items may improve the achievement of some behavioral objectives 100 percent. A single word or appropriate question posed at a specific point in a learning sequence may likewise result in success for more students. These same words or questions posed at some other point in the sequence may not help at all, and, in some cases may result in "noise" in the system. Elimination of some of the useless activities has been painful, because many of the activities were of my own design or provided an enjoyable experience for me.

Another change in the GAS has appeared, although the GAS remains much as it was initially. Students are now permitted to make their own decisions regarding attendance. No trick questions are inserted in examinations to trap those who do not attend, however.

Changes made in substituting the integrated quiz session (IQS) for the previous small assembly session (SAS) have been previously noted.

Inquiry in the Audio-Tutorial System

The audio-tutorial system lets the student know rather precisely what is expected of him. An array of learning experiences and media are arranged by the instructor to lead the student to opportunities for attainment of those objectives. The system is designed to open to the student a maximum of options which he may select according to his learning needs, capabilities, and interest. Included are options for several different kinds of inquiry. Postlethwait focuses on these: (19)

> First, let us define levels of inquiry. Inquiry occurs at various levels with the maximum or first level of inquiry represented by research. The second level of inquiry is the type of experimentation which can be completed in the span of a three-hour laboratory. The third level of inquiry is one in which the busy work of doing the experimentation is completed by the instructor and the student is asked to collect data from the results and analyze these data. The fourth

level of inquiry is to provide the student with data and ask the student to analyze the data. The fifth, of course, would not be considered real inquiry but merely a demonstration. All of these levels of inquiry are feasible under the audio-tutorial system. At the first level, our students are asked to do two miniature research projects - (in) the first we provide guidance throughout the project but the second is left totally to the initiative of the student. In the first the problem is defined, the materials and methods are described, the student is told what data to collect and asked to analyze these data and write up the project in the format of a scientific paper. The second project is completed by those students who hope to make an "A" in the course and here the student is restricted only by the materials available to him. He defines the problem, decides on the experimental procedure, what data to collect, analyzes these data, and writes up his project in the form of a scientific paper.

At the second level of inquiry, a problem is defined for an experiment requiring two to four hours and is done in the ISS as well under the audio-tutorial system as under the conventional system. The subsequent levels of inquiry are also handled effectively in the ISS.

The Postlethwait audio-tutorial system appears to allow inclusion of all those learning experiences usually open to students in the conventional lecture-laboratory-recitation method. It further appears to make possible a number of advantages not open to the student in the conventional method. Evaluative evidence for its equivalency or its superiority is included in Chapter IV.

CHAPTER III

AUDIO-TUTORIAL PRACTICES IN CALIFORNIA COMMUNITY COLLEGES

Seventy of the ninety-one California Community Colleges have indicated that they are now (forty-seven) or will be (twenty-three) using the audio-tutorial method in the near (three to five year) future. A number of these, as indicated in Table 1, have been using audio-tutorials in their operations since the middle 1960's. A much greater number have initiated their AT programs only in the last two years, and still more (nineteen) are either experimenting with materials preparation, or are simply keeping abreast of audio-tutorial developments against the possible development of programs. While those colleges in the latter group indicated that they did not now have definite plans for initiating audio-tutorials, only two colleges responded that on the basis of what they now knew of audio-tutorials, they had rejected this method of instruction in their own futures.

Burgess Audio-Tutorial Systems notes that it now has installations in more than two hundred colleges in the United States and Canada. (20) Increases in the number of installations is occurring in terms that Burgess describes as "exponential". Variations in audio-tutorials are as numberous as are audio-tutorials. In the manner of most course presentations, instructors have their own unique contributions to make in content, organization, presentation, and relations with students. Just as no two instructors would make identical use of the same printed text-lecture method, so no two instructors appear to make identical use of the audio-tutorial method. It should be stressed that audio-tutorial is a method, not an established content, and given this

understanding, wide variations in applications are to be expected.

Equipment

Most audio-tutorials begin with a booth arrangement in which each student has a bench space about three feet long and twenty to twenty-four inches in depth. Usually, booths are enclosed at the rear and the sides to break student vision and provide a mounting space for equipment and instructional materials. Pegboard partitions for flexibility in displaying materials are most common. A number of students with whom I chatted in various laboratories indicated that while there was enough space for most requirements, in some cases they would have liked a little more depth for spreading out notebooks, guides, objective sheets and other materials.

Equipment placed within the audio-tutorial booth varies greatly. Most equipment used is unmodified standard pieces of audio-visual equipment, or commercially constructed audio-tutorial booths or carrels. Eighty-nine per cent of the colleges answering this question indicated they had made no modifications. Minor modifications made included additional filtering for power line inputs, selection of alternate long-life lamps for 8mm projectors, and film-strip projector lamp exchanges also made for longer life. A number of tape recorders have been altered to add solenoids to prevent erasures in booths where master-recording facilities have been provided. Some schools have constructed carrels locally, and inserted standard AV equipment. Los Angeles Valley College has locally fabricated a single-unit slide-tape unit, while Columbia College is prototyping a double-cassette (audio and visual) unit capable of taking audio-tutorial packaged units which it is also developing. In all cases where projection equipment is used in audio-tutorial

carrels, projectors have been equipped with short-throw-distance lenses. Visual screens range from commercial rear-screen units to painted or papered screen-like squares which make a projection surface. In large installations, instructors recommend air conditioning for those times when high percentages of AT booths are in use and equipment is generating much heat. Fullerton College reports that push-button slow backup features for tape units might be omitted since students tend not to use this feature, but to use the rewind action instead. Omitting this feature on tape play units would result in an approximate $100 saving per unit. Where high-speed tape duplicating is not available, most schools recommend that carrels be wired for recording from the instructor's master unit.

Twenty-five of the thirty-four California colleges contributing operational details noted they were using tape recorders, but not all colleges using audio-tutorial responded to this question. Where tape units are recorded from a master record position, only one master tape need be kept. Where various units are available to students not all taking the same work within any given week, more tapes must be stored. In this event, it is practical to use both sides of tape reels or cassettes. Little reel-to-reel breakage has been experienced, and colleges using reel-to-reel see no reason to switch to cassettes. Newer installations tend to use cassettes for storage convenience. Tape slices in reel-to-reel are more quickly accomplished than when the tapes are cassetted. In instances where cassetted tapes have broken, the colleges have reported it to be less expensive to replace the broken tape with a new one than to tear down cassettes for repair. Equipment with multi-channel capability cuts storage requirements. For example, Santa Rosa

stores eight weeks of instruction on one four-channel tape unit. Only three colleges reported an intent to switch from reel-to-reel to cassettes.

The second most common piece of equipment at the audio-tutorial station is the 35mm projector for slides, reported by thirteen colleges. Again it must be noted that all colleges did not respond to the equipment question. Film strip projectors for 35mm were reported by five colleges. None reported the use of combination slide-filmstrip equipment. Several colleges direct the student in the AT lab to a special station where 8mm projection equipment is located. Postlethwait (1969) reports keeping film projectors loose, and moving them to carrels as needed for any weekly ISS unit. Several schools report a special station with 8mm film loop equipment for supplemental use for students who wish to pursue a limited topic to more depth than that covered in the ISS unit. Sparks (1969) has found the value of the loop film projectors in the laboratory to be grossly overrated, but adds that they may prove of more value now that sound tracks can so easily be added. Numerous schools do not attempt to incorporate film loop projection into their AT operation. It would appear, however, that as supplementary media, 8mm offers a potential not readily available in any other media at the same cost.

Nearly every manufacturer of audio-visual equipment is represented in one or more of the audio-tutorial laboratories now used. Cost and quality varies greatly.

Golden West reports that the savings in costs of microscopes alone for an additional laboratory is sufficient to equip an audio-tutorial laboratory for initial and minimal operation. Savings from microscopes not required in AT method has enabled some colleges, such as Columbia, to purchase much higher

quality microscopes for student use at those limited times when microscopes are required. Although Postlethwait (1969) reported the use of 16mm magnetic sound cartridge machines, only one California college reports similar use. In most installations, equipment placed in carrels is fixed in place, but the colleges report a variety of equipment mobile enough to be used by students in the AT lab as needed. Slide-tape units, sound-on-slide, pictures, microscopes, super-8mm reel-to-reel and 16mm units are used when incorporated into AT units. Although a number of California Community Colleges have television and video-tape recording capability, none reported any intent to develop video as a part of their audio-tutorial method. Five of the national schools reported television use, although in the strictest sense only three of these constitute audio-tutorial use. The most flexible use of television with AT was reported by Brian Fagan at U.C. Santa Barbara, where television is used to visually introduce students to elements of an AT anthropology. Indiana State University (Sparks) reports a second presentation of the GAS by TV. Development of TV playback units for low-cost home or school use is expected to make preparation of some materials easier, faster, and afford more flexibility than schools now find with 8mm film.

California schools reported little vandalism in audio-tutorial carrels. Little loss of equipment has been experienced, and at least one school, Lassen Community College, reports that students may check equipment out for home use.

Structure of Audio-Tutorial Sessions

More California community colleges are using the ISS than any other component from the Postlethwait system. Twenty-six of the 34 schools which responded to the questionnaire were using ISS (76%). Some used GAS for

integration of other AT sessions as does Postlethwait, and a number had given up GAS entirely. Only fourteen colleges reported general assembly sessions (41%). Some reported GAS for lecture use with materials related to ISS, and a few were presenting GAS lectures which were not in any way related to the remainder of the AT system, but were presentations on topics of interest to students today. Some colleges used GAS related to ISS topics or present-day issues. SAS use was noted by fourteen colleges (41%), with considerable variety in what it was used for - integration, quizzing, discussion, etc. Outside assignments, the home study session of Postlethwait, was used by eight California Community Colleges (24%).

Such a variety of application would probably be applauded by Postlethwait, who once commented on the need for "bold restructuring, uninhibited by the needs of janitors and administrators." (21) To this list, apparently, may now be added systems originators.

Colleges report using conventional lecture and ISS, audio-tutorial-type GAS and ISS. Each is used with or without SAS. When true audio-tutorial GAS is used, there is no hard content presentation. One, two and three weekly hours of lecture-GAS were reported.

Although Postlethwait abandoned the SAS for the IQS several years ago, none of the colleges in the California sample reported use of the IQS - all small session references were to SAS. All still quiz weekly, however. Among the national colleges reporting, Catonsville finds the weekly quiz helps students discipline their study. Parkland College reports use of both the SAS and the IQS. Ball State (Nisbit, et al, 1969) has created what is termed a response session, where the weekly quiz is integrated with a student

response system.

The ISS is an area of considerable experimentation by both faculty and students. Individualization of instruction and accounting for individual differences were paramount reasons for its creation. "It was just not fair," said Postlethwait, "If a student had the desire and the capacity (to learn) that he was discriminated against by his academic background." (22) Postlethwait (1965a) found that the student develops a sense of responsibility for his own learning and reacts favorably to being treated as an adult. The built-in flexibility of student scheduling permits some students to procrastinate, a condition assuming (Sparks) near epidemic levels near vacations. Reedly finds the "poor" student cannot force himself to work in the audio-tutorial circumstance, and mediated courses appear (Monroe) to be more necessary and essential for the less independent student. For other students, since there is always a laboratory assistant in the laboratory room, they feel free (Deardon) to go there for help in the course. Santa Barbara reports that students took advantage of the availability of carrels during lunch hours, late afternoon hours, vacation periods, evening hours, and when it could be arranged, weekends.

Since the student is not forced to proceed quickly to a new topic, any topic which he finds especially interesting can be explored to any depth he desires, subject to available resources (Postlethwait, 1965a). Students find there is no urgency to rush through materials in order to meet deadlines, and the student proceeds (Postlethwait, 1965a) in a more relaxed fashion with his mind more receptive. Los Angeles Pierce College notes that an improvement in student attitude toward laboratory experience has resulted in more students

achieving "C" or better grades.

Although not many student miss AT ISS assignments, students who have had illnesses, accidents, or personal hardships which would seriously impair their progress in traditional lecture courses are able to make up their ISS losses (Santa Barbara).

Postlethwait (1965a) suggested that since the student has full control of the rate of study, he is able to spend his time in the classroom actually learning the materials rather than "information collecting" for future learning. The use of scripts in ISS shifted the audio-tutorial lab emphasis (Sparks) from a place to learn to a place to get notes to study later.

Instructors in audio-tutorials, aware of student spans of attention, try not to have more than ten minutes without having the student do something (Myers and Bailey). Similarly, most instructors aim at thirty to thirty-five minutes of direct tape play, although actual unit lengths may range from seventeen to seventy minutes. Myers and Bailey also note that when longer units are prepared, it is convenient if tapes have one or more stopping points so that a student may divide the unit into two or more sessions if he desires. Although these authors aimed at a two and one-half hour laboratory session, students spent as little as half an hour and as much as five hours to completion, averaging from two and a half to three and a half hours. Some students thus are able to compress completion time. Columbia College instructors believe that this compression enables some students to effectively carry more than eighteen quarter units of load.

Two interesting circumstances were reported for the ISS. At Santa Barbara, students not enrolled in the audio-tutorial course sat down at

booths to try it out before enrollment. Bethany (West Virginia) College has eliminated the ISS booth. Carrels there have given way to bench arrangements without sides to facilitate student-to-student interaction. No noise problem has arisen, and students may work in pairs or small groups if they desire. Similarly, Seattle Community College staffs a study room from 8:00 a.m. to 9:00 p.m. where a student may go with questions.

Time Spent in Audio-Tutorial Laboratories

Time spent by students to complete units in an audio-tutorial laboratory is a function of individual differences, interruptions, student-to-student interface, availability of required materials, and unit construction. It thus seems a myriad of variables cloud the time-to-master issue too much for generalization. Most AT instructors appear to have started with the idea of developing a laboratory experience which would take a middle "C" student about two and a half or three hours to complete. Feedback has resulted in the preparation of shorter tapes, usually aiming at thirty to thirty-five minutes of running time, and generally skip requiring the two and a half or three hours for completion time. The most common complaint directed toward tape operations in a new audio-tutorial operation is length of time required. Still, using most tapes, student completion times vary from about half an hour to five or six hours. Tape rooms (Catonsville) tend to be conducive to informal student-to-student discussion, and this kind of peer group instruction seems to be effective. In most audio-tutorials, it is encouraged. The group spending the most time in laboratory (Deardon) is the student group which is slightly above average. Students who attain higher grades appear to spend more time in laboratories, although it is not clear whether they are engaged in the

required or in supplemental and enriching work. The seeming correlation of laboratory time spent by students and grade results is considered with a section on grades earned, below.

Some students, given the opportunity to progress through an audio-tutorial course rather than being limited to progress through only one week's work, make unusual achievements. Santa Barbara, for example, two-thirds of the way through a usual semester, found thirty percent of the students had completed from eighty to one hundred percent of requirements. Another ten percent were from sixty to eighty percent complete; thirty-five percent were from forty to sixty percent complete and ten percent of the students were more than twenty percent but less than forty percent complete. At this point in the semester, three percent of enrolled students were less than twenty percent completed, and another twelve percent had withdrawn. In an audio-tutorial course in typing, Johnson reports some students completing the requirements in a month, while Sherman reports capable students completing an available AT History course in seven or eight weeks. Numbers of students, particularly in the community colleges, can benefit from taking two semesters to complete a course--others tandem two courses in a semester.

In some cases, more time in the AT laboratory is required of the student by the availability of practice machines, and outside practice is reduced (Walters, 1970). If indeed there is a tendency to take more of the time which students formerly spent in outside study into the audio-tutorial requirements of the course, the impact on states whose apportionment is based on hours of attendance is staggering to the imagination.

Changes in Course Content

Initiation of an audio-tutorial course requires a massive restructuring.

In this transition, and keeping the time required of students constant, it appears that there is an opportunity to increase course content which can be presented by AT in the same time required previously for a conventional course. Postlethwait, having taught general Botany at Purdue for more than sixteen years, estimates that the audio-tutorial course contained approximately fifty percent more information than previously (Postlethwait, 1965a). Golden West College estimates that it can add one-third to one-half more content in the same time required for conventional instruction. Others (Myers and Bailey) more conservatively estimate a change of twenty percent. Increased content will vary from program to program, a circumstance which Santa Barbara generalizes well with the comment that students can learn more if more is included in the program.

Questionnaire responses from the California Community Colleges note that most believe that the instructor gains time formerly required in information presentation. Sixty-five percent note that a portion of this newly-found time was spent in greater instructor-student face-to-face contact. Nearly one-third of the colleges reported that this time was filled simply by having more students. Another sixty-five percent reported portions of newly-found instructor time went into preparation of AT materials. Sixty-five percent developed new materials. The question permitted multiple responses.

Materials Preparation

The great bulk of California colleges responding to questions concerning materials preparation indicated local preparation. Of the thirty colleges responding, seventeen (56%) prepared AT materials locally, seven colleges reported commercial preparation only (23%), and six colleges (20%) reported

using both locally and commercially prepared materials. Responses to this question may have been clouded by those colleges which prepare materials locally for commercial duplication.

Postlethwait (1967) has commented on materials development for a course prepared for the audio-tutorial system:

> Education is a science so that one must define the problem first and then go about logically developing a procedure which permits a student to engage in those activities which result in learning. It may require a total restructuring of courses and reorganization of approaches. Teaching is an art but the artistry comes not through the use of the teacher as a communication device but rather in his skill in determining objectives and developing the materials and sequences which will enable the student to achieve those objectives in the most efficient and effective manner.
>
> Many of us find this approach to education a little difficult.

Unquestionably, the preparation time for audio-tutorial is greater than the preparation time required for conventional instruction (Jackson State Community College). The elimination of "ego-inflating" lectures and other "pet" activities is painful (Postlethwait, 1965b) to the majority of teachers, especially since the substitute for them is a lot of hard work. Yet most of the creativity of course presentation lies in the preparation of materials.

Mt. San Jacinto College estimates that if all costs are considered, each fifty-minute audio-tape lesson costs approximately twenty-five hundred dollars. The college estimates five hundred hours of preparation time before the first audio-tutorial lesson is ready for a subject field such as nursing. Sparks found that more attention goes into the writing of scripts for the preparation of a course than into any other facet of the program. Once materials have been selected, related to objectives, and sequenced, ten or

more hours may be expended in preparation of the final audio tape (Harford Junior College). Even when there is an abundant collection of slide and other materials at hand from which to develop an AT instructional unit, as is the case at Columbia College, it was estimated that thirty to fifty hours of preparation time is required to complete an audio-tutorial unit.

Mt. San Jacinto College, which like Columbia College was built for instruction by the audio-tutorial method, has included supervision of production in its administrative system. It has legitimized the connections between administration and faculty by creating a joint responsibility for production of audio-tutorial instruction units. It stresses that when the instructor knows that his work will be displayed, he is encouraged to his best efforts. Materials are field tested in other California colleges under different instructors, and outside evaluators are utilized to examine the system and its materials prior to duplication and commercial distribution.

A number of colleges, like Mt. San Jacinto, release an instructor from a portion of his usual load when he is engaged in the preparation of audio-tutorial materials. Other colleges encourage and indeed, hire, faculty to produce materials during the summer, when teaching pressures are relieved.

In discussions of the materials preparation with various faculty, it was noted that the materials preparation problem polarized thinking into three groups: (1) audio-tutorials are of no value unless they are locally produced, tailored to the instructional strengths of the participating faculty, and for the local students; (2) colleges initiating AT programs should buy commercial materials if they can as an insurance against instructor exhaustion before the new course is ready to go, and amend these materials to meet local

circumstances; and (3) commercial purchases should be deferred until about the end of the first year, when all objectives have been tried, and the preparing faculty has a very firm idea of the kinds of commercial materials needed to improve its program.

Program and Performance Objectives

Twenty-eight California Community Colleges responded to the question "Is your audio-tutorial operation predicated upon development of student terminal performance objectives?" Nineteen colleges (68%) responded positively; nine colleges (32%) negatively.

Monroe suggests that objectives are most necessary for the least independent or most dependent students. He further found the "match" or integration of objectives, practices, and evaluation - ie, objectives, materials, and observed student performances - to be the key to audio-tutorial success, for he measured success in terms of percentages of students achieving percentages of objectives. For example, programmed instruction writers speak of 90-90 programs, or those in which ninety percent of the students will achieve ninety percent of the objectives. Most schools, Monroe surmised, are around a 75-75 rating, ie, seventy-five percent of the students achieve around seventy-five percent of the objectives. Poor schools are 70-70, good schools 80-80. Civil Aeronautics Board GCA (Ground Control Approach) schools for air traffic controllers strive for 95-95, and astronaut training programs quest for 95-100 - ie, ninety-five percent of the astronauts will be able to acquire one hundred percent of the required skills. An audio-tutorial college, according to Monroe, should aim at 85-85. He suggested, at Mt. San Jacinto, that the college, using its multi-media or audio-tutorial

approach, had achieved 85-80 by 1967.

Some audio-tutorial colleges have tested this evaluations approach. Monterey Peninsula College, for example, has created an experimental unit for audio-tutorial instruction in chemistry, with a reported 97% achievement of objectives by students. Parkland College tests factual objectives with objective examinations, and conceptual objectives by oral quizzes (Blazier). Much has been written of terminal performance, measurable objectives. Little is known of their application; still less of their use as measures of course or institutional effectiveness.

Feedback for Materials Improvement

Twenty-seven of the California Community Colleges reported that their audio-tutorial operations were predicated on constant student feedback and revision of instructional materials (87% of the thirty-one responses). Four colleges (13%) responded negatively.

Feedback in most of the audio-tutorial programs is effected through oral and written quizzes administered to students in either the IQS or the SAS. In either event, instructors have a means by which they can identify those portions of the audio-tutorial ISS materials which are not being learned or achieved by students, and can make revisions to remedy these omissions. Postlethwait (1965a) notes that students can participate in the decision as to whether they have learned the subject matter adequately. They are not forced to cover subject matter already known, but can devote their time to more useful studies.

Students who require help during an ISS presentation can get it immediately, and in context with their study. This not only assists the student so

that later excercises or activities are built upon a stronger foundation of information, but it can also afford feedback to identify portions of ISS materials where students have difficulty. Free exchange of ideas with fellow students and instructors either by chance contact in the ISS or by deliberate (quiz) conversations enables the student to clarify his own thinking about the subject matter and both the student and the instructor immediately know whether or not correct emphasis is being given to intended ideas.

A number of the AT colleges place more information before the AT instructor about his students than he has had available in the past. Golden West College, for example, has coupled this information into the computer, so that the instructor now knows of his students their SCAT placements, high school grades, college grade point average, math proficiency, and some diagnostic test information. At Golden West, the student in laboratory can take a quiz when he is ready, from a pre-programmed computer terminal, with immediate knowledge of results. At the same time, the instructor is afforded a record of the progress of a student, a tabulation of the time he has spent in the laboratory, and both the instructor and the student immediately identify and can discuss any student errors. Student rank-in-class lists can also be prepared.

Fullerton College, in its audio-tutorial math programs, affords the same kind of opportunity through the use of a test-scoring machine. The Fullerton student may, when he is ready, secure a quiz card from the laboratory clerk, and take his quiz. Upon completion, he scores the result and may immediately discuss the results with an instructor in the lab. For the student, there is an additional self-diagnostic circumstance built into the Fullerton materials,

for the content is cross-indexed so that if a student has difficulty with a function or concept, he is directed to related text sections for additional work. In this sense, the Fullerton math materials are a branching audio-tutorial program.

Apparently there is an increasing use of student-corrected quizzes or examinations. Whether this is for student knowledge of results, instructor feedback for course improvement, or for administrative convenience is not known. There are, however, some interesting variants on procedure. Meramec Community College, for example, administers examinations on two-part pressure-sensitive "chemical carbon" paper. The student completing his examination turns in the original and keeps the second copy. Outside the lecture hall, the correct responses are posted and the instructor is on hand to answer questions and permit students to grade their own examinations. This procedure affords the student immediate knowledge of results, and at the same time permits the instructor to become aware of those portions of the presentation which students are not learning, and to take corrective action.

While instructor awareness of non-learning need not always result in course or materials revision, there is evidence that audio-tutorials are revised more frequently than conventional courses (Monroe). Fullerton, for example, reports three full revisions of its audio-tutorial mathematics program in three years. Similarly, Heilman reports more course revision in three years of audio-tutorial operation than in the previous seven years.

Instructor Time Use in Audio-Tutorials

A 1968 study (Roy) notes that in mathematics classes that build on previously acquired information, instructors spend up to one-third of their time

in class in review of previous material. Audio-tutorial instruction affords the possibility of encapsulating review, supplemental, or enriching materials and freeing the instructor from these rather routine forms of information display.

The audio-tutorial system was not, however, initiated with the intent of lightening teacher loads. Postlethwait (1967) sees teaching as a responsibility - a responsibility to the teacher to provide unlimited opportunity to his students to learn.

The California Community Colleges reported on how instructors were using the time they gained in applying the audio-tutorial method. Sixty-five percent noted that there was an increase in instructor contact with individual students.

Postlethwait (1965a) alludes to the differences between possibility and practice: "There is an opportunity" (italics mine) "for more meaningful personal contact between the student and an instructor. The Instructor can tailor his teaching activities to the individual needs of the student." Elsewhere, (Postlethwait, 1967) he continues in this regard:

> We find (in audio-tutorial teaching) personal contact is actually enhanced. We now have relegated much of the routine of teaching to a routine vehicle and teacher's time now can be devoted to meaningful personal contact. The opportunities for personal contact are as follows:
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> 1. As in the conventional lecture system, the senior instructor is available at the General Assembly Session for this kind of personal contact (such as it is).
>
> 2. In the Independent Study Session an instructor is available to give direct attention to individual needs on a one-to-one basis for any problem requiring instructor assistance.

3. The Integrated Quiz Session provides an opportunity for every student to become well known by at least one instructor in the course, and every student to know at least one instructor very well. Additional opportunity is available for every student to know many instructors well but there is no alternative but to become well acquainted with at least one instructor.

Mt. San Jacinto College notes again that the purpose of audio-tutorial is not to relieve the teacher of his load. Rather, it is to give a better, more individualized, personal-contact education to the same number of students. Time spent in interface with audio-tutorial materials does not constitute greater personalization, although the tutorial tone of taped materials may simulate this. Neither is an increase in apportionment hours equatable with greater personalization or individualization. Achievement of greater personal contact with the instructors of a course rests solely with the instructors, in audio-tutorial as in any other teaching format. The teacher in audio-tutorial is free, as indicated by Walters (1970) to help individual students. Yet it appears (Sparks) that the senior staff must be willing to work harder in an audio-tutorial circumstance than in conventional instruction. Similarly, it appears that instructors must choose to develop greater contact with students if that goal is to be attained.

In this sense, when audio-tutorial is tried, it is not the method which is on trial (Sparks), it is the staff. Discussion with faculty would lead one to conclude that audio-tutorial cannot be assigned to staff; they must elect it. Golden West notes that staff is selected for Biology, and also for audio-tutorial.

Differentiated Staff

Purdue initiated its audio-tutorial system with the same staff which had previously instructed conventional Botany - ie, one senior instructor, one full-time instructor, eight half-time TAs, two undergraduate assistants and one half-time clerk. Differentiated staff functions were quickly evident.

The senior instructor has overall responsibility for the organization and planning of the course - its content, procedures, the timing of tests, etc. He is responsible for the GAS, and conducts several SAS (now IQS). He conducts all weekly sessions for briefing other staff and integrating other course components.

The full-time instructor prepares materials or supervises their preparation. He is responsible for writing the homework problems and test items. He plans the miniature research problems, schedules work assignments, and supervises the preparation of ISS materials. He also conducts SAS (IQS) and monitors ISS.

Teaching assistants each prepared one of two units for ISS, ordered materials for it, developed needed materials, grew plants, etc. The TA planned the AT booth arrangement for his ISS with the full-time instructor. One booth was set up, and undergraduate assistants duplicated, and later disassembled and stored. TAs, all graduate students, evaluated students in oral quizzes and miniature research projects, and functioned in the ISS and SAS. Undergraduate TAs did routine grading and housekeeping duties. The secretary recorded all grades, prepared grade lists, deficiency reports, etc.

Availability of graduate teaching assistants, possible for the four-year institutions, is usually not feasible for the two-year college. There are,

however, differentiated staff functions in the community colleges, although somewhat different in nature. The community colleges of California have concentrated on the use of paraprofessionals to assist in audio-tutorial systems. About half (ten) of the colleges use paraprofessionals. These assistants, varying from professionally prepared persons to student aides, perform numerous functions associated with AT. They are in some cases (six) responsible for lab supervision and capable of answering questions dealing with course content (five).

The remaining colleges used paraprofessionals in more varied tasks. One used technicians for all audio-visual work, another used an assistant to develop, for ISS use, materials which had been designed by instructors. Others used assistants for laboratory set-up, mechanical-clerical help, as student tutors, to handle laboratory materials at booths, or for technical duplication of tapes and other instructional materials. In those cases where assistants are not content-competent, student questions are referred to instructors or are raised in small group sessions. In a number of cases, tutors keep records, administer unit feedback questionnaires, etc. In other cases, these functions are assisted by computerization.

Audio-Tutorial Units-To-Students Ratios

It is not possible to cite a fixed ration of AT units (hardware or student stations) to students. This ratio is a function of how many hours the laboratory is open, and the number of students and the number of stations. Requirements also vary according to subject matter being presented and the time needed for AT unit completion. Depending on the time during which the laboratory is open, and the staff available to man the laboratory, it appears

that only representative experiences can be cited.

Postlethwait found that one tape unit would serve approximately twenty students. Large colleges report serving one thousand students with eighty-four units, a ratio of twelve students to each tape unit. Smaller colleges have higher ratios - one tape unit to twenty or twenty-five students. A number of programs assigned to departments, however, have lesser ratios, in the area of 1:7 or 1:8. It would appear that 1:20 was the most common ratio, with open hours adjusted according to the number of students using tape units. All other equipment in the audio-tutorial carrel is a direct function of the programming and materials used, and is dependent entirely upon local development.

Administration and Operations Observations

The most common administrative attachment of the audio-tutorial facility among the thirty-four responding California Community Colleges is to the department (fourteen colleges, or forty-one percent). Six colleges (18%) attach the AT lab to a division, a similar number and percentage are located in the library, and eleven colleges (32%) have placed audio-tutorials in a separate learning center. It should be noted that several colleges have AT units located both in the department or division, and in the learning center.

Future expectations indicate that eleven colleges will continue to place AT with the departments (32%), six will retain division attachment (18%), library attachments will drop to four colleges (12%) and independent learning centers will increase to fifteen (44%).

Location and type of facilities available influences audio-tutorials. If student freedom of inquiry is to be emphasized, for example, materials, print

resources, and equipment must be available for student use. If student-to-student or student-faculty relationships are to be encourged, a suitable seminar or conference facility needs to be provided. Blazier has suggested that for the most beneficial student-teacher interaction, the learning center needs to have a majority of carrels occupied by students - a function of the time the center is open in relation to the number of students and the number of student stations. When only a few carrels are filled, students appear reluctant to initiate exchanges with instructors who are present but who are not already in discussion or question-answer relations with students. He has also suggested that a higher proportion of carrels in use increases student-to-student interchange, also considered to be important in the overall learning environment.

A number of schools stressing personalization of courses taught by audio-tutorial method aid instructors in getting acquainted with students by name by using student cards which are placed at AT stations and which contain not only the student's name, but his picture. Similarly, photographs are used as visual seating charts in CAS.

Another administrative question for consideration is whether the AT lab is intended to be a quiet or a non-quiet study area. At East Los Angeles College, for example, an audio-tutorial skills development center, there were large numbers of students in the center, and a high room noise level which did not in any way seem to distract students. Bethany (West Virginia) College encourages the use of its AT facility for straight study evenings, and has eliminated the booth to foster student-to-student study.

Recent Developments in Audio-Tutorials

One of the more recent developments in audio-tutorial instruction is the development of the "minicourse" (Purdue) or the ATP Audio-tutorial package (Columbia College). Either is a self-contained audio-tutorial program of instruction which is packaged with all learning materials required for student use. A similar illustration would be the multi-media program units of Mt. San Jacinto College.

These units, generally short, single-concept type units, are potential resource units to be used by students as they would use a book from a library shelf. When interested, the student would simply check out the unit and complete it in an audio-tutorial carrel. At Purdue, Hurst notes that minicourse units are prepared along lines suggested by Bloom's "Learning for Mastery" suggestions - ie, the student may not complete the unit, but he cannot fail. Shorter than most ISS units, the minicourse program units tend to be of a "core" nature, common to more than one course, and complete with GAS, ISS, and IQS. Some are required of students, and others are optional. The student who completes optional minicourses may, at Purdue, "bank" his minicourse credit against the time when he takes a course in which they are required.

Columbia is engaged in development of audio-tutorial packaged units which would be available in two cassettes - one audio and one visual. Mt. San Jacinto College is already making its audio-tutorial programs available to other institutions.

Bennett reports the packaging of AT units to be sent into the field to assist practitioners in maintaining currency with recent developments in their field. There are, of course, interesting possibilities in this regard

for all of continuing education. Practitioners engaged in the Purdue AT extension testing indicated they would like to have AT units available on a mail-out basis. It is interesting to note that of the thirty-three practitioners engaged in the study, twenty-four would like to have additional mail-out units, and twenty-two indicated a willingness to provide at their own cost the recorders and projectors which the AT units would require.

One is also encouraged to note that there are now audio-tutorials in such numbers across the country that commercial firms are beginning to become interested in the preparation of software rather than in the selling of hardware. Equally encouraging is the great variety of subject fields in which the audio-tutorial method is being applied.

Pages 48 and 49 (Audio-Tutorial Programs in California Community Colleges by Discipline or Subject) have been omitted due to lack of reproducibility.

AUDIO-TUTORIAL PRACTICES IN CALIFORNIA COMMUNITY COLLEGES

	AT Use Now	Future Use	Used Since	AT Stations Now	Planned AT Stations Future	Included in Initial Survey	Responded to Full Questionnaire	AT for Present Use
Alameda	No	Yes				Yes	Yes	
American River	Yes	Yes	1968	4		Yes	No	Reg + Exp
Antelope Valley	Yes	Yes		3	8	Yes	Yes	Interest
Bakersfield	Yes	Yes				Yes	Yes	Reg + Exp
Barstow	No	No				Yes	Yes	E
Butte	No	Yes				Yes	Yes	
Cabrillo	Yes	Yes	1968	12		Yes	Yes	E, Lab
Canada	No	Yes				Yes	Yes	
Canyons	No	Yes				No	Yes	
Cerritos	Yes	Yes	1967	7		Yes	No	R
Chabot	Yes	Yes			40	Yes	No	E
Chaffey	No	Yes				Yes	Yes	
Citrus	No	Yes				Yes	Yes	I
Columbia	Yes	Yes	1968	56	96	Yes	Yes	R, E, L
Compton	No	Yes				Yes	Yes	I
Cosumnes River	Yes	Yes	1970	30		No	Yes	L
Contra Costa	Yes	Yes	1969	4		Yes	Yes	R, E
Cuesta	No	Yes				Yes	Yes	I
Cypress	Yes	Yes			24	Yes	No	Exp
De Anza	Yes	Yes	1968	30		Yes	Yes	L
Desert	No	Yes				Yes	No	
Diablo Valley	Yes	Yes	1969		64	Yes	Yes	E
East Los Angeles	Yes	Yes	1965	48	40	Yes	Yes	R, E
El Camino	Yes	Yes	1969		40	Yes	Yes	E
Feather River	No	Yes	1969			Yes	Yes	
Foothill	Yes	Yes	1968	36		Yes	Yes	R
Fresno	No	Yes				Yes	No	R
Fullerton	Yes	Yes	1967	72	18	Yes	Yes	R
Gavilan	No	Yes				Yes	Yes	I
Glendale	No	Yes				Yes	Yes	I
Golden West	Yes	Yes	1966	175		Yes	Yes	R
Grossmont	No	Yes	(1970)	39		Yes	[illegible]	(R)
(Allen) Hancock	No	Yes				Yes	Yes	I
Hartnell	No	Yes		12		Yes	Yes	I
Imperial Valley						No	No	
Laney	Yes	Yes	1967	50	70	Yes	Yes	L
Lassen	Yes	Yes	1969	1		Yes	Yes	E
Long Beach	Yes	Yes				Yes	Yes	R
Los Angeles City	Yes	Yes	1966	30	65	Yes	No	R
Los Angeles Harbor	Yes	Yes	1965	82		Yes	Yes	L
Los Angeles Pierce	Yes	Yes	1968	20	8	Yes	Yes	E, L
Los Angeles Southwest	Yes	Yes	1969			Yes	No	R
Los Angeles Valley	Yes	Yes	1968	5		Yes	Yes	
Los Angeles Trade-Tech	No	Yes				Yes	Yes	
Marin	Yes	Yes	1969	1	80	Yes	Yes	R
Merced	Yes	Yes	1968	14		Yes	Yes	R
Merritt	No	Yes				Yes	Yes	
Mira Costa	Yes	Yes				Yes	Yes	E
Modesto	No	Yes				Yes	Yes	
Monterey Peninsula	Yes	Yes	1969	1		Yes	Yes	E
Moorpark	No	Yes				Yes	No	
Mt. San Antonio	No					Yes	No	
Mt. San Jacinto	Yes	Yes	1965	138		Yes	Yes	R.
Napa	Yes	Yes	1968	94		Yes	Yes	E

	AT Use Now	Future Use	Used Since	AT Stations Now	Planned AT Stations Future	Included in Initial Survey	Responded to Full Questionnaire	AT for Present Use
Chione	No	No	(1968)			Yes	Yes	(E)
Orange Coast	Yes	Yes	1968	4		Yes	No	L
Palomar	No					Yes	No	
Palo Verde	No	Yes				Yes	Yes	
Pasadena	No	Yes				Yes	Yes	
Porterville	No	Yes				Yes	Yes	
Redwoods	No	Yes				Yes	Yes	
Reedley	Yes	Yes	1968	24		Yes	Yes	R, L
Rio Hondo	Yes	Yes	1969	24	25	Yes	Yes	L
Riverside	No	Yes				Yes	Yes	
Sacramento City	Yes	Yes	1969			Yes	Yes	R, E
Saddleback	No	Yes	1969			Yes	Yes	E
San Bernardino	No					Yes	No	
San Diego City	No	Yes				Yes	Yes	E
San Diego Mesa	No	No				Yes	Yes	I
San Francisco	Yes	Yes	1969	30		Yes	Yes	I
San Joaquin Delta	No	Yes				Yes	Yes	I
San Jose City	Yes	Yes	1968	150		Yes	Yes	E
San Mateo	Yes	Yes	1969	50	20	Yes	Yes	L
Santa Ana	No	Yes	(1970)		80	Yes	Yes	(R)
Santa Barbara	Yes	Yes		4		Yes	Yes	L
Santa Monica	No	Yes				Yes	Yes	
Santa Rosa	Yes	Yes	1969	24		Yes	Yes	R
Sequoias	No	Yes	(1970)			Yes	Yes	(R)
Shasta	Yes	Yes	1967	5		Yes	Yes	L
Sierra	Yes	Yes	1969	100		Yes	No	L,E
Siskiyous	No	Yes				Yes	Yes	I
Skyline	Yes	Yes	1969	87		Yes	Yes	R, L
Solano	Yes	Yes	1967	15		Yes	Yes	L
Southwestern	Yes	Yes	1968	36		Yes	Yes	R
Taft	No	Yes				Yes	Yes	
Ventura	No					Yes	No	
Victor Valley	No	No				Yes	No	
West Hills	Yes	Yes	1969	2		Yes	Yes	E, L
West Los Angeles	Yes	Yes	1968	9	46	Yes	Yes	R
West Valley	No	No				Yes	Yes	
Yuba	No	No				Yes	Yes	

SUMMARY

Now using Audio-Tutorial — 47 = 52% of survey, 53% of responses
Not using Audio-Tutorial — 42 = 46% of survey, 47% of responses
No response — 2 = 2% of survey
Total — 91

Expect to use AT in future:
- Yes — 79 = 87% of survey, 93% of responses
- No — 6 = 7% of survey, 7% of responses
- No response — 6 = 7% of survey, 7% of responses
- Total — 91

Colleges included in initial survey — 89/91 = 98% of California Community Colleges
Colleges responding to questionnaire — 79/91 = 87% of California Community Colleges
No response — 12/91 = 13% of California Community Colleges

Use of Audio-Tutorial
- No Response — 27 = 30% of survey
- For regular coursework — 27 = 30% of survey, 42% of responses
- For laboratories — 15 = 15% of survey, 23% of responses
- Experimentally — 21 = 23% of survey, 33% of responses
- Interest only — 12 = 13% of survey, 19% of responses

CHAPTER IV

EVALUATIONS OF AUDIO-TUTORIAL METHOD

Thirty-four California Community Colleges were able to contribute details of evaluations they had made of their audio-tutorial method. Fifteen other junior colleges across the nation provided information, as did thirty-six four-year colleges and universities. None of these institutions had collected evaluative data on all of the questions posed in the questionnaire, and the information which follows summarizes responses and selects illustrative detail.

Sixty-five percent of the California Community Colleges had evaluated one or more factors of their AT operation. The remainder of the colleges, although operating ATs, had not.

Most of the colleges looked at increased numbers of students served by audio-tutorial methods, at grades received by individual students, at course grade distributions, and had sampled student opinion regarding AT. Few colleges had undertaken measures under control vs experimental circumstances, and few colleges had objective data to report concerning measured student learning or comparative operational costs.

Illustrative of the more thorough evaluations which have been made of one or more aspects of the audio-tutorial method are those of James Arnwine and Bill Juby of Independence Community Junior College (Kansas); Luis E. Folgueras, Delta College, Michigan; D. D. Husband and S. N. Postlethwait, Purdue University; Fred Machetanz, Los Angeles Valley College, California; R. Stafford North, Oklahoma Christian College; the various writings of S. N. Postlethwait, Purdue; Phillip D. Sparks, Wisconsin State University; and

John R. Welser and J. J. Stockton, Purdue. Many other individuals had conducted inquiries into audio-tutorial operations in a more limited scope than the authors listed above.

Few differences in evaluations of audio-tutorials were evident between the returns from the eighteen community colleges across the nation which were selected as "benchmark" colleges because of their experiences in the AT method, and the returns from the California Community Colleges. Few institutions had evaluative information relating to operating costs of AT compared to conventional instruction. Few had considered facilities use as an evaluation factor, or had utilized attainment of objectives as an evaluative measure.

Most had looked at changing enrollments, grades earned by students, and grade distribution patterns - all of which were subject to considerable contamination when viewed, as did most colleges, in a pre-post AT study. No college had attempted, for example, pre- and post-treatment measures of achievement on standardized tests, using conventional and audio-tutorial groups. Neither had there been evaluations stemming from the performance of high grade point average students compared with low grade point average students in AT instruction, although the AT method rests on the assumption that these differences could be alleviated by the student with time as a variable.

In spite of the lack of evidence within their institutions, seventy-six percent of the California Community Colleges reported a belief that students did indeed learn more by AT, although indicating (78%) that they had no evidence to support this belief. Sixty-two percent of the California sample expressed the belief that more students could be accommodated by AT method with the same resources, compared with conventional instruction. While half of the

colleges reporting noted a belief that retention of students was better in AT instruction than in conventional instruction, forty-six percent noted retention was about the same, and one college (4%) felt retention was less by AT method.

Time Required for Mastery of Content

Husband and Postlethwait, correlating the time a student spends in ISS with grades received in the course, found a nearly straight-line relationship. Their results are included below.

A	students spent	3.3 to 3.5	average weekly	hours in ISS
B	"	3.2 to 3.4	"	"
C		2.8 to 3.1	"	"
D	"	2.5 to 2.9	"	"
F	"	1.8 to 2.3	"	"

They also report a comparison of time spent in the entire course by conventional and AT instructions, again by grade levels.

	Conventional	AT
	Lec + Lab = Total	GAS + IQS + ISS = Total
A grade	2 + 4 = 6	1 + .5 + 3.6 = 5.1
B	2 + 4 = 6	1 + .5 + 3.4 = 4.9
C	2 + 4 = 6	1 + .5 + 3.2 = 4.7
D	2 + 4 = 6	1 + .5 + 2.9 = 4.4
F	2 + 4 = 6	1 + .5 + 2.4 = 3.9
Overall Average	2 + 4 = 6	1 + .5 + 3.2 = 4.7

Coupled to Postlethwait's belief that content has increased from one-third to one-half by audio-tutorial, these times do indeed support the concept that the student learns more in less time. Similar results are supported by data from numerous colleges.

While students feel (64%) that they spend more time in AT than in study for other courses (Nord and Sparks), such responses might well be expected

from any student comparing the time he spends on a six- or seven-hour conventional Biology course compared with his three-hour English or History courses. That students spend less time to learn more in AT laboratories than in conventional laboratories is rather clear from numerous reports (Deardon; Brewer; Walters, 1969; Richason and others).

Individual students vary greatly in the time spent to secure the various letter grades, and vary within the grades. Zimmerman, for example, reports an average time spent of 2.7 hours for the "F" student to 3.8 hours for the "A" student, but notes that some "A" students spent 2.5 hours and some "A" students spent five hours. Tope concluded that students spent no more time in in AT lab than in the conventional lab. Welser, in a control-experimental group circumstance, found students required eighty-one minutes on the average in audio-tutorial against 57 minutes in lecture-recitation method, and concluded that LR was more efficient <u>in student time</u> in that study. Yet he also reported that sixty-two of the students responded that they had "saved" time in AT learning. The students also noted in the Welser study that they took time to back up tapes and repeat in AT. One well might ask how students can learn more, work harder, and save time. How well the student applies his time and effort needs inquiry, as does a measure for retention of learning by AT vs conventional instruction.

<u>Individual Student Grades Earned</u>

Postlethwait (1965a) grades on an absolute percentage basis, and has found that grades have risen for students at all levels. Numerous colleges report that students earn from one-half to one full grade point higher by audio-tutorial instruction than by conventional instruction. Richason reports

that individual student grades have increased by 28.75 percent. Boyce noted that "A" grades increased threefold at the initiation of the audio-tutorial system at Golden West College. Golden West reports the student with a low "D" high school record, followed by a low "D" college GPA. Investigating the circumstance which put him in high scoring position in his Biology (AT) class, it was noted that he had recorded approximately eleven hours each week in ISS. Reports that from 25% to 68% of classes in AT receive "A" and "B" grades are not uncommon. Most colleges note a diminishment in "D" and "F" grades, considered below with grade distributions.

Student Grade Distributions

Most colleges report an upward skewing of the grade curves for AT classes. A number of schools report little change in the number of "A" and "F" grades, but that "D" grades move to "C's", and "C" grades move, in part, to become "B's". Others report fewer "D" and "F" grades, and more "A's" and "B's". Golden West, for example, reports "B" grades (in AT) increased by 8% over conventional while there was a 10% increase in "C" grades. Southwest College reports 7% fewer "F's", 14% fewer "D's", and 14% more "C's". Jackson State Community College reports "F" grades have dropped from 25% of students enrolled in conventional instruction, to 3.3% when instructed by AT. Numerous other examples of this kind of grade distribution changes are available. Yet some colleges, like Columbia, recycle the student who has not met objectives, and few fail. Recent tendencies to increase Credit-No Credit grading also warps the lower end of the grading spectrum. While one may wonder about the self-fulfilling prophecy, colleges continue to report students do better (gradewise) by audio-tutorial method compared to conventional instruction.

A comparison of grading practices over the past five years would, it is suspected, reveal a considerable shift in grading practices of instructors. One such comparison, relating Fall, 1969 grades awarded to Fall, 1965 grades awarded institution-wide, indicated 58% more "A" grades in the former, 37% more "B" grades, and 34% fewer "D" grades, with 68% fewer "F" grades. At the same time, "W" grades increased by 43%. Instruction in both periods was conventional, for day students. When liberalization of faculty attitudes, institutional grading practices, implementation of performance objectives, and other possible contaminants are considered, one is led inevitably to question grade results as indications of superior instructional methods. There appears to be no question, however, but that instructors believe students achieve higher grades by AT method compared with conventional instruction.

Student Drop-Out from Audio-Tutorials

Postlethwait (1967) reported:

> The percentage of failures under the audio-tutorial system has greatly decreased from that under conventional teaching method. But. . . . . there will still be those students who fail. However. . . . . we feel that their failure is not our fault, that we have not put stumbling blocks in the way of their succeeding in the course.

Peterson, generalizing from experiences reported with AT, notes there is a higher retention rate in classes using AT approach than conventional means. West Los Angeles College notes a significant difference in attrition when audio-tutorials are compared with conventional courses. Boyce notes that failures and dropouts decreased by 66% when AT was initiated at Golden West College. Golden West still reports a conventional dropout of 40% and an AT dropout of 20%. Fullerton found a conventional math dropout rate of 50%,

which was reduced to 20-23% after audio-tutorial instruction. Weaver indicated a 40% conventional instruction dropout, and a 10% AT dropout at El Centro College. Monroe, experimenting at Mt. San Jacinto College, found that when students were denied audio-tutorial practice in skills courses, their achievement went down 11% and their dropout rate increased. Numerous other and similar examples could be cited.

Sparks summarizes the dropout issue most succinctly. "Most of the time a student who fails the course fails because he lacks the self-discipline to attack the course in the recommended way. He either learns to adapt and handle the freedom designed within the course, or he fails again." (23) Columbia Community College, designed for and institutionally strongly committed to the audio-tutorial approach, includes in its philosophy and guiding principles statement to students and community: "The student may fail the institution if he chooses, but the institution shall not fail the student."

Student Attitudes and Opinions Regarding Audio-Tutorials

By far the most numerous of the appraisals made of instruction by the audio-tutorial method are samples of student opinion and attitudes. Students reacted to various questions concerning audio-tutorial method or courses as follows (all comparisons are AT vs conventional instruction):

66% of students in AT felt all students should have an AT course (Nord and Sparks)

71% responded that they knew what was expected of them in AT (Nord and Sparks)

78% felt AT was the best organized course they were taking (Nord and Sparks)

77% felt AT was sequenced better than conventional (Sather)

9% felt AT put too much responsibility on the student. 77% disagreed (Gelinas)

Preference for AT over conventional ran 65% (Nord and Sparks); 89% (Smith, Skold and Swingle); 90% (Fullerton); 89% (Sherman); 89% (East Los Angeles College); 94% (Sather)

72% (Gelinas), 88% (Blazier) or 98% (Sherman) would recommend the AT course to other students

59% had discussed the AT course with at least one other student before enrolling (Nord and Sparks)

61% felt they identified better with the AT instructor (Sather)

77% preferred AT identification with instructor to conventional (Sather)

66% felt there was no loss of contact with instructors in AT (Richason)

73% rated AT as being more difficult than the average lower division course, although they recommended to others that they take the course (Zimmerman)

92% felt AT stimulated them to a higher performance than conventional (Sather)

32% missed some portions of instructor delivery by conventional lecture method, no student missed any portion of AT presentation (Welser)

84% felt AT motivated them more to learn - 6% felt that motivation was decreased by AT (Zimmerman)

88% felt they spent more overall lab and outside study time in the lecture method compared with AT (Sather)

87% felt AT was much more effective (Sherman)

75% felt teaching in AT was more thorough (Welser)

87% noted more ease of learning by AT (Sather)

59% felt AT more flexible for in-depth investigation (Sather)

3% studied often in addition to AT. 49% studied seldom other than AT. 49% studied very seldom other than AT. Identical responses were evoked from the conventional group (Welser)

There is no doubt that students have a more favorable attitude toward the AT method of instruction than one would expect in the conventional method (Husband and Postlethwait). In an evaluation of courses by students and sponsored by student government, AT Biology (Purdue) was higher than all other freshman-level courses and was surpassed by one upper division course, and it was also taught by AT (Husband and Postlethwait).

The GAS did not fare as well in student surveys as did AT generally. Nord and Sparks found students responding that if quizzes were given elsewhere, 74% of the students felt they would have gotten along as well without GAS. In an operating AT without a GAS, only 52% responded that they would have liked a GAS lecture (Gelinas). In a comparison study, 6% of the control group thought the lecture was of little value while in the experimental (AT) group, no student indicated that taped lecture presentations were of little value (Machetanz).

Questions relating to the SAS or IQS were responded to by students as below:

64% were nervous in IQS but got over it. 16% were never nervous. 19% never got over their nervousness in IQS (Sather)

93% found the small session helpful. 57% would have volunteered for an additional session other than the one to which they were assigned (Nord and Sparks)

84% preferred the regularity of AT testing to the irregularity (variable test schedule) of conventional (Sather)

95% preferred oral quizing (Sather)

86% felt they were fairly treated in oral quiz evaluation. 10% felt they were rated high, 5% felt they were rated low (Sather)

90% felt they learned more because of the oral quiz. 10% felt the oral quiz hindered learning (Sather)

59% "liked" history at entrance into the AT course. 100% "liked" history at the end of instruction by AT (Sherman)

Student responses to questions dealing with ISS included these:

88% liked to look at something as it was being described (Gelinas)

80% preferred ISS to conventional laboratory (Blazier)

79% preferred ISS time to the suggestion that ISS time be cut and an additional lecture added. 62% preferred ISS time to the suggestion that ISS time be cut and more discission added (Smith, Skold and Swingle)

72% did not want a scheduled ISS (Nord and Sparks)

27% indicated they were bothered by earphones, 73% indicated they were seldom bothered by earphones (Welser)

85% felt headphones and having an individual study area minimizes distractions by other students (Gelinas)

66% felt most of the learning of the course took place in ISS (Gelinas)

83% felt they spent more time in AT lab than in a conventional lab (Sather)

32% indicated a preference for a variety of instructor voices on tapes. 68% would not (Nord and Sparks)

10% thought it harder to learn from tapes. 83% disagreed (Gelinas)

78% used tape repeats in ISS, 18% seldom repeated (Gelinas)

82% felt AT without a study guide would be "impossible" (Gelinas)

99% felt written lab scripts helped (Nord and Sparks)

56% often discussed lab experiments with other students. 25% did not (Gelinas)

To these should be added one observation stemming from my own discussions of AT with students on campuses in California. All students to whom the question was put indicated they would not like audio-tutorial materials shelved in

libraries and separated from instructors

Measures of Student Learning by AT

Shasta College reports students are enthusiastic for their greater involvement in instruction and learning by the audio-tutorial method. Monroe, at Mt. San Jacinto College, noted that the student feels his effort to learn is more important under AT, that he works harder, and that he feels he does indeed learn more. Yet there are few studies which have sought to document the amount which a student learns by audio-tutorial method in comparison with more conventional approaches. El Centro College reports finding no significant differences in learning by AT according to sex or age (Weaver). Miami-Dade plans, but has not yet conducted, a study to compare slide-tape, slide-script, and slide-tape-script variations.

Four studies have made comparisons. In the first of these (Welser et al), 72 students were divided into groups of 30, 30, and 12. The subject matter was split into Parts I and II. Group A was treated in Part I by AT, while Group B received a conventional lecture-recitation approach. During Part II, instruction for these two groups was reversed, with A instructed by lecture-recitation, and Group B instructed by AT. Group C received AT in both Part I and Part II. Evaluation of tests administered for the content parts indicated no significant differences. The audio-tutorial components were fully self-administered by students, no instructor was on duty in the AT lab. Welser's conclusion was that students learned as well by AT as by conventional instruction.

In a second study, conducted at Prairie State College, Sherman found the mean test result in a history presentation by AT to be 85 while the mean result for the conventional group was 63. Grade percentage comparisons to the

same standards, for instruction by the same instructor, are given below:

Grade	AT	Conv.
% A	35	5
% B	44	18
% C	32	16
% D	5	45
% F	0	0

Sherman's comparison consisted of forty-six students handled by the audio-tutorial method and 22 students treated in conventional instruction during the previous semester.

East Los Angeles College compared forty students in a control group with forty students in an audio-tutorial experience. On the average, students from the AT group performed 1.14 grade points higher than students in the control group. Thirteen students selected from previous conventional course participants performed nearly two full grade points higher than scheduled through the audio-tutorial method. Four students in the sample elevated grades from F to A.

Arnwine and Juby, at Independence Community College, established a predictive instrument which incorporated high school Biology grades, ACT composite scores, and college Biology grades previously earned by students. A computer program was developed to establish a predicted score and grade for these students. Instructors in the conventional and the audio-tutorial groups did not know these students until after grades were recorded. Fifteen students were predicted to attain "D" or "F" grades from the eighteen-student sample, while three were predicted to receive "C" grades. On the basis of a 1% level of significance, with one degree of freedom, in a chi square distribution analysis, other than predicted grade results would not have occurred by chance in one out of one thousand trials. That fourteen of the AT students earned "C" grades,

and only four earned "D" or "F" grades, was attributed to audio-tutorial treatment.

AT Performance by Students of Different Abilities

None of the colleges in the sample had developed data to indicate how students of different ability levels progressed in an audio-tutorial and controlled experiment. A number of colleges did report subjective feelings of instructors involved, however.

Walters (1969) concludes that there is, by AT, a faster advancement of slower students. This is supported by Deardon, who notes that students of lower ability feel very free to stay longer in the lab, or return for review sessions. Boone concluded that the weaker students tend to lean on stronger students in the audio-tutorial circumstance. Still, Deardon concluded that AT lab work does not significantly favor any ability group - that evidently all are helped. Mt. San Antonio College experience with AT leads to the position that while lower grade point average students and the academically interested learn more by AT, some higher GPA students are angered by the AT system. Los Angeles Pierce College noted that the work done by the higher GPA student is supplemental and enriching, while lower GPA students perform generally one grade level better than by conventional instruction. Columbia Community College instructors conclude that AT appears best for the top student and for the plodding student.

East Los Angeles College, operating an AT "skills center" found that students who logged time in the center did better in course grade results than students who did not log time in the center. Of those who did work in skills development, those spending more time in the AT system for skills development

performed one-half grade point higher than those who spent less time in the center.

Students Served vs Resources Expended

Postlethwait's (1969) estimates of resource demands of AT and conventional instruction remain the most comprehensive. Postlethwait's comparison is based on providing instruction for four hundred eighty students by either method, with the following results:

	Conventional	AT
Students served	480	480
Senior staff	1	1
Instructors	1	1
Teaching Assistants	10 (half time)	8 (half time)
Course credit	4 hours	4 hours
Student time required	2 hrs lecture/week	1 hr GAS/week
	1 hr recit/week	1 hr SAS/week
	3 hrs lab/week	4 hrs ISS/week
	1 semester	1 semester
Space		
Prep room	1	1
Greenhouse	1 section	1 section
Auditorium (420 capacity)	4 hrs/week	2 hrs/week
Recitation room	16 hrs/week	16 hrs/week
Lab (36 x 26')	1 room FT	1 room FT
	Plus: 1 room 9 hrs/week	22 AT booths
	14 3-hr sessions if	15 hrs/day
	expanded for 798 students	6 days/week for
		800 students

Considerations for the above estimates:

1. SAS space requirements increase 1 room/1hour/week/30 students. For GAS, no increase up to 840 students. 1 AT booth/20 students.
2. Time not usually scheduled (lunch, etc.) is used in AT by students with unusual schedules.
3. 1 AT lab accommodates 600 students while 2 rooms are required in conventional instruction.
4. Reduced lecture hall scheduling for GAS releases the hall for other use.

	Conventional	AT
Equipment:		
Microscopes	72	22 (1/booth)
Slide sets	72	22
Plant materials	72	22
Special demonstration set-ups	18	1 or 2
Tape players	0	22
Tape sets	0	22

(Less equipment and fewer demonstration set-ups serve more students)

Time requirements per week:		
Staff	18	12
TA contact hours	104	88
Preparation hours	110	90
Total:	232 hours	190 hours
Student hours	2,840	2,160

Considerations to accompany time requirements:

1. For an increase of 30 students, staff time increases 1 hour per week. Other staff activities increase ca. 10 hours per week per 200 student hours.
2. AT facilities are not occupied by students who have already mastered materials. Minimizes idle activities destructive to equipment and morale.

Postlethwait has also found that the average amount of time spent per week per student for the first semester was a little over two and one-half hours in the AT system in contrast with four hours per week scheduled for each student in the conventional system (Postlethwait 1965a).

Few colleges were prepared to report data considering these requirements for comparative instructions. Southwest College reported an increased enrollment in the same space with the same staff. Golden West noted it served five hundred students in AT Biology with two and two-fifths less staff than it had utilized for conventional instruction for the same number of students. Behringer tempers comparisons with the suggestion that since each AT student

works as an individual, rather than in lab teams, supply costs rise somewhat. Rio Hondo College, on the other hand, expects that in the switch from conventional to AT instruction, the number of laboratories can be reduced by half. The data available would support Postlethwait's (1965a) conclusion that there is a reduction in space requirements and equipment needs for instruction by the AT method.

AT Cost Estimates

Peterson notes that initial costs for AT will probably be higher both in equipment expenditure and in instructor time expenditure to establish an audio-tutorial system. Once implemented, he notes the time will be less and additional equipment needs limited, mostly being confined to maintenance. Cost per student, he notes, is a function of use of equipment and other resources.

Postlethwait (1969) again has the most complete cost estimates for the comparative systems, again for 480 students:

	Conventional	AT
Equipment:		
Tape playback units	0	22 @ $100 = $2,200
Tape sets	0	22 @ $140 = 3,080
AT booths	0	22 @ $10 = 220
Microscopes	72 @ $125 = $8,800	22 @ $125 = 2,750
Hot plates	18 @ $20 = 360	2 @ $20 = 40
Other	18 @ $100 = 1,800	2 @ $100 = 200
Total:	$11,960	$8,490
Supplies estimate:	$1,500	$1,000
Staff:		
Senior staff @ $10,000	1 3/4 = $17,500	1 = $10,000
Instructors	1 = 6,000	1 = 6,000
TA's @ $2,200	10 = 22,000	8 = 17,600
Total:	$45,500	$33,600
Grand Total:	$58,960	$43,090

Factors to consider:

1. Conversion to AT saves $8,970 in equipment costs to offset $5,500 investment in tape units, tape and booths.
2. Estimated annual salary savings, $11,900.
3. Staff time increases 2 hours for every 25 students.
4. A class of 36 students requires two lab sessions, each for 18 students, or 9 duplicate team set-ups. AT needs only 2.
5. Tape recorder costs are non-recurring and dependent upon selection. Booth costs may vary considerably.

Sparks has undertaken a similar appraisal for an audio-tutorial lab to accommodate 1,250 students. In his estimate, 7 hours/semester for GAS is estimated at $2,500, 42 hours of SAS at $12,500, 60 hours ISS student help at $1,200, 64 hours ISS staff at $16,000, and additional ISS help at $1,700. AT instruction thus would total $33,900. Conventional costs are estimated at 10 sections of conventional lecture, or 30 hours, costing $10,000; and 42 sections of laboratory requiring 84 hours and costing $24,000. Conventional costs total $34,000, not significantly different from the AT estimated cost. Sparks concluded that regardless of how the program is administered, AT is not likely to cost less. Carrel costs range from slightly more than $100 each for local fabrication, to $750 each. Average carrel costs appear to be between $400 and $500 each, depending on the equipment selected and the materials used. These costs can be amortized over the seven-year life expectancy of equipment, while carrels should be expected to last longer.

At least two California colleges, reimbursed with state funds for student attendance, calculate that increased student time spent in AT will defray equipment and materials costs in less than two years.

Quality of Instruction

Oklahoma Christian College, locating its audio-tutorial carrels in its library, found a twenty to thirty-eight percent increase in the circulation of

books after the opening of the center (North). It also assessed that there was a sixty percent efficiency increase on the part of participating instructors, and that student time in study increased by twenty-five percent.

Short found that fifty-minute traditional lectures, concisely stated, can be put into a thirty-two minute running time tape. Richason, after twelve semesters of AT Geography instruction, finds forty percent more content by AT than by conventional methods. Harford Junior College notes that student reports from AT lab are of higher quality than those from conventional labs. Students report (Myers and Bailey) that they study harder for the weekly oral quizzes of AT than for written ones, and Walters reports that standards have been raised by AT. Monroe attributes sixty percent of difference in learning to the individual student, thirty percent to the instructor, and ten percent to the instructional method. Audio-tutorial method aims at making better use of the forty percent learning leverage available to an institution.

Welser found that seventy-nine percent of AT session students interrupted tape presentations for replay, while only two percent of the students in lecture-recitation method interrupted presentations although thirty-three percent in L-R indicated that they would have liked to have asked for repetition. Similarly, eighty-five percent of the students in an AT session repeated slides, while again only two percent of the students in the conventional asked for slide repeats, although twenty-nine percent indicated they would liked to have had some slide repetitions.

Behringer suggests that pooling the talents of the instructional staff in one audio-tutorial laboratory situation dilutes the weaknesses of any individual instructor. Instructors learn from one another - a valuable aspect, and

one good instructor can exert a favorable influence on all others. He concluded that instructors take pride in contributing constructive ideas for improving programs and can contribute from their individual areas of graduate specialties to improve the quality of instruction.

CHAPTER V

CONCLUSION

S. N. Postlethwait, writing of evaluation, comments:

> It is very difficult to get good data on the effectiveness of the audio-tutorial system. The most obvious reason is the lack of quality control on the structuring of programs. I think that one should expect the same kind of results as with the lecture system, that is, some people are effective as lecturers and others are not. So I think it will be with the audio-tutorial system, some people will be effective and others will not.

One is lead by the experiences of others, however, to form opinions and conclusions regarding audio-tutorial instruction.

Faculty in audio-tutorial instruction appear to be more enthusiastic for the AT system than faculty in the lecture method are enthusiastic for the lecture system. An enormous amount of work is required for faculty who engage in the AT method, and one would be hard-pressed to find an audio-tutorial instructor who seriously considered his "load". Audio-tutorial instructors must, in most cases, develop their own instructional materials, resulting in a personalization of the course not always evident in lecture presentations. One would conclude, however, that there is a wisdom in beginning audio-tutorial instruction with a goodly amount of commercial material which can be amended for local use.

Students in audio-tutorial do learn more, in less time. The orientation of course construction away from teacher preparation and delivery and toward student learning appears to have wholesome ramifications. Emphasis on measures of attainment of established objectives encourages both the student and the

faculty to self-assessment. Student self-pacing, knowledge of objectives and knowledge of results, coupled with convenience of scheduling student learning times, are overwhelmingly and favorably commented upon by students. From three-quarters to ninety plus percent of the students prefer audio-tutorial to conventional method when they have experienced both. Student performances, according to grades attained, are better in AT presentations than in conventional instruction. Learner involvement in learning is educationally sound, theory-based, and administratively practical.

There is a greater potential for instructor-student contact in the audio-tutorial system than in conventional method. More students can be accommodated in less space, with less equipment, and at an equal or lesser cost for the same quality of instruction. With the same per-student expenditures, quality of instruction may be improved. Differences in conventional sections of large enrollment courses can be somewhat standardized by the use of audio-tutorial method.

Need for definitive evidence for these and a number of other researchable topics appear warranted from this investigation into audio-tutorial practices and evaluations. What differences in practices or patterns exist between the large-school AT and that of the small school? Does attachment of the AT to the department make learning more effective or enhance teaching any more than if the AT implementation is in a library or a learning center? What evidence can be developed concerning long-range retention of knowledge acquired by AT compared with retention of knowledge acquired conventionally? What real impact on presentations stems from student feedback to instructors? Is there in reality a savings of time in AT, or is there in reality some waste of time in

conventional instruction? Is the locally-developed program any more effective than the AT program created elsewhere and imported? Are there personality differences between the successful audio-tutorial instructor and the successful lecture-recitation instructor? Would the same effort and resources expended in AT produce the same result if expended in conventional instruction?

The most succinct summary of the potentials for the audio-tutorial application is that of A. A. Canfield (1967):

> The general assembly, at its best, is an exciting presentation by a master teacher who weaves together the excitement of past insights and capitalizes on the mysteries of subject matter yet unknown. At its worst the general assembly is a conventional college lecture and an opportunity for taking attendance.
>
> The tutorial laboratory, at its best, is an exciting sequence of learning experiences assembled by a skilled craftsman in which the student progresses from the simple and known via ever-changing and challenging media to the mastery of the complex and unknown. Here he finds a sense of fulfillment that comes only from achievement through self-management and self-discipline. At its worst, it is a place for students to come and read, to talk together, and to visit with a member of the staff.
>
> The weekly evaluation, at its best, is a welcome opportunity for the students and faculty to share in satisfaction of a job well done. It confirms for the teacher the careful selection and molding of media and materials. For the student it is the taste of success and confirmation of ability that spurs him to continued growth in the pursuit of knowledge. At its worst, it is an emotionally-charged period of assessment where the cunning and adroitness of the student are pitted against the autocratic subject-matter expertise of the faculty.
>
> The combination of these elements, at its best, provides the kind of exciting, challenging, stimulating and gratifying learning experience toward which most students and faculty turn with fervor. At its worst, it is a confusing mixture of the old and the new, with the conventional opposition of subject matter and students, of faculty and students, of faculty and administration, of grades and learning.

The audio-tutorial method is not a panacea. Rather, it represents

an opportunity by which colleges may strive for a more meaningful method of managing the educational environment which they provide for students. It offers the opportunity to restructure course content and curricula, to develop for the student of today an educational experience which is valuable to him, which is relevant to his future needs, and in which he can become a willing and able partner and participant. It holds the hope of increased efficiency, greater effectiveness, augmented personalization, and a more provocative treatment of differing individuals.

Among the ninety-one California Community Colleges, forty-seven percent are now using the method. Another twenty-five percent intend to do so in the near future. Still another twenty-one percent is following audio-tutorial developments with interest. When ninety-three percent of the community colleges in a system as extensive as California's can make this kind of commitment to a method, they stand in significant endorsement of its merit and potential.

NON-CALIFORNIA JUNIOR COLLEGES CONTRIBUTING INFORMATION

* Bay Path Junior College, Massachusetts
  Catonsville Community College, Florida
* Cuyahoga Community College, Ohio
* Delta College, Michigan
* El Centro College, Texas
  Gainesville Junior College, Georgia
  Harford Junior College, Maryland
* Harrisburg Area Community College, Pennsylvania
* Independence Community College, Kansas
* Jackson State Community College, Tennessee
* Lansing Community College, Michigan
* Manatee Junior College, Florida
  Meramec Community College, Missouri
* Miami-Dade Junior College, Florida
* North Hennepin State Junior College, Minnesota
* Oklahoma Christian College, Oklahoma
* Oakland Community College, Michigan
  Parkland College, Illinois
* Quinsigamod Community College, Massachusetts
* Seattle Community College, Washington
* St. Louis Junior College District, Missouri
* St. Petersburg Junior College, Florida
* Tarrant County Junior College, Texas

Thornton Community College, Illinois

* Tyler Junior College, Texas

*(Questionnaire sent to these colleges)

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2. It is interesting to note that of the thirty California Community Colleges using audio-tutorial instruction before Fall, 1969, twenty-seven percent traced their interest directly to this conference. An additional ten percent noted that interest had been initiated elsewhere, but that they had been much influenced by S. N. Postlethwait since the conference.

3. Descriptions given in this chapter for the Purdue audio-tutorial are excerpted or paraphrased from S. N. Postlethwait, J. Novak and N. Murray, An Integrated Experience Approach to Learning - With Emphasis in Independent Study (Minneapolis, Minn., Burgess Publishing Co., 1964).

4. Supplementary descriptive details of the Postlethwait system are contained in the various writings of Postlethwait and in Husband, D.D., and S. N. Postlethwait, The Concept of Audio-Tutorial Teaching (Lafayette, Ind., Purdue University, Biological Sciences Department, n.d.) This paper is the introductory chapter of a doctoral dissertation in the Department of Biological Sciences, Purdue University.

5. Dr. Postlethwait prepared a case-study statement on the "History and Evolution of the Audio-Tutorial System" for inclusion in Audio-Tutorial Instruction: A Strategy for Teaching Introductory College Geology, (Washington, D. C., Council on Education in the Geological Sciences, 1970) Publication Number 4.

6. Ibid, 6

7. Husband and Postlethwait, op. cit., 17

8. Postlethwait et al, 1964, op. cit., 105

9. American Geological Institute, Publication Number 4, 3

10. Husband and Postlethwait, loc. cit.

11. W. J. McKeachie and W. Hiler, "The Problems Oriented Approach to Teaching Psychology" J. Ed. Psychology, 45:224

12. American Geological Institute, op. cit., 4

13. S. N. Postlethwait, Statement during presentation to the Innovative Junior College Conference, UCLA, Jan. 4, 1966.

14. American Geological Institute, op. cit., 4
15. S. N. Postlethwait, Pacific Speech, Vol. 1, No. 4 (1967) 60
16. American Geological Institute, op. cit., 4
17. Supra
18. Ibid, 6
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