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AUDIO-TUTORIAL SYSTEMS APPROACH TO RECREATIONAL LEARNING

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CHAPTER I. INTRODUCTION

Excellence in education is news, as evidenced by recent reports of numerous groups and individuals (A Nation at Risk, 1983). Included among these are the recently published national effective schools study (Bickel, 1983), the study of schooling ("Some Implications for School Improvement," 1983), and the recent report on secondary education in America by the Carnegie Foundation for the Advancement of Teaching (Boyer, 1983). The American Alliance for Health, Physical Education, Recreation and Dance concurs that there is a need for evaluation and review of the direction of the physical education curriculum (Francke, 1983).

Need for the Study

The efforts of Hunter (1983) have prompted numerous innovations in the profession. As a result, the effective physical educator is expected to make three interrelated types of decisions--those related to content, student behavior and teacher behavior as he/she applies four sets of related skills: (1) selecting an objective at the correct level of difficulty; (2) teaching to the objective; (3) monitoring student progress and adjusting instructional level; and (4) applying known principles of learning. This should be viewed as a research based perspective of instructional effectiveness.

The concept of lifelong learning in physical education is gaining in acceptance. A prodigious amount of literature has been produced in the last decade supporting this concept. Case (1975) states that the interest in lifelong learning for many represents a basic need to escape the routine of a highly structured environment--to give vent to the unexplored capacities and interests of minds that seek refreshment and renewal through active learning. The adult learner, according to Stoval (1979), is eager to explore a variety of offerings in health, physical education, recreation, and dance. The need for additional course offerings has probably doubled in the last decade.

The improvement of educational effectiveness is a continuing struggle for educational institutions. The desire of educators and institutional administrators to discover more efficient and effective means of disseminating large amounts of knowledge to more people in an era of financial stringency is increasing. In their quest for excellence, institutions of higher education are challenged to increase both efficiency and excellence. It is extremely important that such institutions ascertain what are the most effective methods of instruction whereby students will retain what they have been taught.

For numerous reasons, college teachers are developing alternative approaches to conventional teaching methods.

After reviewing the vast amount of research comparing the lecture with other forms of instruction, the lecture appears to have decreasing value in certain areas of the teaching/learning process (Costin, 1972). "Lectures were once useful; but now, when all can read, and books are so numerous, lectures are unnecessary. . ." (Boswell, 1981, p. 471). "As a means of imparting information, especially if habitually used, the formal lecture is probably the most ineffective and wasteful of all methods" (Schueler, 1951, p. 92).

The lecture in its traditional sense has its value as a means of instruction and should not be overlooked. "In spite of its disadvantages, the lecture remains the most effective means by which you may transmit to your whole class of students the subject matter of your teaching" (Weston, 1951, p. 65).

The lecture, then, remains significant. However, as instructors study their teaching performance and look at communicating information at higher levels of learning, they often seek alternative teaching systems to the lecture. "A suspicion arises, however, supported by bits of evidence, that other methods of teaching may be more effective than lecturing in achieving some of the higher level cognitive and attitudinal objectives" (McKeachie, 1967, p. 8).

The concern at this point is to select an approach that will best serve the needs of the teacher and students rather

than just replacing an "old idea" with a new one.

> . . . the pressure to "invent" the new methods comes from an increasing awareness that the old methods are no longer adequate to meet our needs (McKeachie, 1967, p. 8).

Before leaping into new styles of teaching, it is advisable that the instructor determine the selection of an approach by using some sort of criteria.

The emphasis on excellence, research and systems which are able to reach more students with less instructional personnel justifies continued study of audio-tutorial systems approaches to recreational learning and selection of criteria that answer the following questions. Can audio-tutorial materials of high quality be developed in the cognitive area of recreation? Does the use of audio-tutorial materials affect students' attitudes and participation during the duration of a course? Does the use of audio-tutorial materials affect the level of motivation to continue to participate in recreation? The need for further analysis will be addressed in this study.

Purpose of the Study

Recent technological advances permit us to develop a variety of learning experiences. We can now approach the educational process by creating activities and situations that motivate and involve the learner so that learning becomes exciting. The challenge for educators is to provide

learning experiences which are expertly conceived, ingeniously constructed, and logically sequenced.

The challenge of quality of instruction is also an important factor in the success of the educational process. The goal of this study is to determine the relative effectiveness of the audio-tutorial teaching procedure versus the traditional lecture/lab method of instruction in an Iowa State University Physical Education class. It is also a goal to determine differences between groups controlling variables such as: age, aptitude, G.P.A., etc. It shall also be a purpose of the study to see if the materials developed were effective in an Iowa State University Physical Education audio-tutorial group in predicting future success.

The Problem

Recreation is presently a rapidly growing area in education. A shorter work week, an increase in free time, and a general move by all ages of people to participate actively in a wide variety of recreational activities have contributed to an increased demand in recreational course offerings. The traditional classroom approach is not meeting that demand, due in large part to a shortage of instructors, particularly for courses of short duration, or mini-courses.

The problem of this investigation was to determine if audio-tutorial materials of high quality and effectiveness could be developed for instruction of Iowa State University

students in weight training, skiing, archery, and football officiating, and to evaluate the quality and efficiency of these materials in teaching that course. Specific objectives of this study were:

(1) to determine if effective audio-tutorial materials can be developed for a physical education course;
(2) to determine what effect the audio-tutorial systems approach has on student attitudes;
(3) to determine if students are more motivated in physical education when taught by the audio-tutorial method;
(4) to determine what effects audio-tutorial systems approaches have on student attitudes and motivation in individual subject areas (weight training, skiing, archery, and football officiating);
(5) to determine if the results from this study can be utilized as an effective predictor; and
(6) to provide information that may lead to improved research in future studies.

Hypotheses to be Tested

Cognitive achievement

Hypotheses in this section shall deal with differences in knowledge of a subject at the conclusion of a course.

(1) There will be no significant difference in the post course achievement of the audio-tutorial and lecture/lab classes in weight training and football officiating

students, when initial differences between the two groups have been adjusted with respect to initial knowledge of the class (achievement pretest).

(2) There will be no significant difference in the post course achievement of the audio-tutorial and lecture/lab taught students, when initial differences between the two groups have been adjusted with respect to intellectual aptitude (high school rank) and previous scholastic performance (grade point average) for skiing and archery.

(3) There will be no significant difference in the post course achievement of students in different years in school (of the audio-tutorial and lecture/lab taught students) when initial differences between the two groups have been adjusted with respect to initial knowledge of the course (achievement pretest) for weight training and football officiating.

(4) There will be no significant difference in the post course achievement of students in different years in school (of the audio-tutorial and lecture/lab taught students) when initial differences between the two groups have been adjusted with respect to intellectual aptitude (high school rank) and previous scholastic performance (grade point average) for skiing and archery.

Individual factors

Hypotheses in this section shall deal with differences in individual factors during a course.

(1) There will be no significant difference in weight room attendance frequency, when initial differences between the two groups have been adjusted with respect to initial knowledge of weight training (achievement pretest).

(2) There will be no significant difference in duration of weight room attendance, when initial differences between the two groups have been adjusted with respect to initial knowledge of weight training (achievement pretest).

(3) There will be no significant difference in posttest lift when initial differences between the two groups have been adjusted with respect to pretest lift.

(4) There will be no significant difference in body weight change, pre course to post course, when initial differences between the two groups have been adjusted with respect to initial knowledge of weight training (achievement pretest).

(5) There will be no significant difference in football officiating skill evaluation, when initial differences between the two groups have been adjusted with respect to initial knowledge of football officiating (achievement pretest).

(6) There will be no significant difference in archery

target score improvement, when initial differences between the two have been adjusted with respect to intellectual aptitude (high school rank) and previous scholastic performance (grade point average).

Prediction

Hypotheses in this section will deal with the possibility of prediction of student knowledge of a subject at the end of a course.

(1) There will be no significant relationships among posttest score and sport area, method of teaching, achievement pretest and selected demographic variables.

Attitude

A review will be made of responses to an expanded version of the course evaluation instrument developed by the Iowa State University Government of the Student Body.

Definition of Terms

Audio-Tutorial System - a self-pacing multimedia system of instruction that features tape-recorded lessons with kits of learning materials and instruction sheets for individual learning in study carrels.

Lecture/Lab Instruction - a traditional approach that emphasizes classroom instruction and evaluation.

Pretest - an examination to determine student knowledge of a subject prior to starting a course.

Posttest - an examination at the end of the course to determine the student's knowledge of a subject at the conclusion of a course.

High School Rank - the academic position of an individual in relation to academic performance of other members of his/her high school class.

Grade Point Average - student's average grades for courses taken at Iowa State University. Standardization is done by taking each student's freshman year grade point average.

Attendance Frequency - data based on how frequently a student attends a class in days.

Attendance Duration - data based on how long a student stays in class in minutes.

Body Weights - student's individual weight as recorded at the start and the end of a course.

Archery Target Score - points earned by a student as determined by the location and number of target hits by arrows.

Football Officiating Skill Evaluation - a score determined by observation of basic football officiating skills on the playing field.

Year in School - three classifications of students included underclassmen and women (freshmen and women and sophomore men and women), upperclassmen and women

(junior and senior men and women), and graduate students (all post undergraduates).

Organization of the Study

Chapter I is an introduction for this study. It includes background information, need for the study, purpose of the study, the problem, the hypotheses and definition of terms. The second chapter contains a literature review. Included are reviews of individualized instruction, audio-tutorial systems, and a summary and analysis of pertinent research. Chapter III emphasizes methodology. Highlights include subjects, design and description of measures employed. Chapter IV presents a discussion of the findings and frequency counts of data collected during the study. The final chapter of the study presents a summary of findings, conclusions, and recommendations for further study.

Investigative Pattern of Research

This study is a continuation of work which began in 1971. The researcher began work on mini-courses which were used on a noncredit basis primarily by students and staff in recreation. Several of these mini-courses were developed each year through 1976. From 1976-1983, data were collected and adjustments made in courses. The material included in this study is a culmination of more than a decade of continuous study and development.

CHAPTER II. REVIEW OF THE LITERATURE

The sources of reference used in this study have included the social sciences citation index, dissertation abstracts, and a computer search of the Educational Resources Information Center (hereafter called ERIC) data. The ERIC search utilized cross referencing of the descriptors audio-tutorial, lecture teaching methods, and physical education, and recreation. The review of the literature examines some of the methods and theories currently being used in teaching as well as a brief review of individualized instruction and more specifically the audio-tutorial method. In the literature related to this study, four general categories seem relevant: (1) methods and theories in teaching; (2) the individual and innovation methods in education; (3) the history of audio-tutorial instruction as developed by S. N. Postlethwait; and (4) a review of related research and ongoing audio-tutorial projects.

Methods and Theories in Teaching

Ausubel's main focus is "reception learning" which is concerned with "the psychology of how individuals comprehend, learn, organize, and remember large volumes of meaningful verbal materials" that they typically encounter in a classroom situation (Ausubel, 1963). According to Ausubel, reception learning, not to be confused with rote

learning, is derived from the instructional process of subject matter presentation rather than the process of discovery. Students must be prepared for the instructional process, and by proper sequencing of instructional materials, new knowledge may be efficiently added to their cognitive structure. To be meaningful, a curriculum must be concerned with the systematic presentation of its subject matter (Ausubel, 1965).

An important principle underlying Bruner's (1963) theories of instruction and process for education is that "any subject can be taught to any child in some honest form." However, the challenge facing the instructional process is to devise properly learning sequences which facilitate the educational process (Bruner, 1965). Since the mind can effectively deal with only a few operations at a single time, disorganized information will probably effect learner frustration and confusion (Bruner, 1961).

Gagné (1970) defines learning as "a change in human disposition or capability, which can be retained, and which is not simply ascribable to the process of growth." Learning is more than just a natural phenomenon that happens as a result of development. It is to a large extent dependent upon events in the environment. And, it is an event that occurs under precise conditions which can be objectively described. In essence, learning is an event which

takes place when a stimulus applied to the learner results in a measurable performance change. The learning which does occur is inferred by comparing performance before and after student involvement within the learning environment.

The Individual and Innovation in Education

The Physical Education Department at Iowa State University offers a wide selection of beginning, intermediate, and advanced courses in the areas of aquatics, dance, and sports. These courses are designed to serve general education purposes for all students. The traditional lecture/laboratory method is used predominantly. Alternative approaches are recognized and encouraged.

Technological applications to education date back to the mid-1800s (Stolurow and Davis, 1965). According to Stolurow and Davis, teaching machines were developed and patented as early as 1866. In 1926, Pressey proclaimed the educational value and feasibility of teaching machines (Pressey, 1926). However, Pressey's recommendation remained unheeded because, as Skinner (1958) pointed out, the "industrial revolution in education" which was predicted "stubbornly refused to come about."

The technological applications to education that finally began to evolve in the 1960s received momentum from the varieties of audio-tutorial aids and the emerging science

of learning (Glaser, 1960). The vast array of media available to the educator offers him powerful and flexible communication tools which have affected his role and the quality of learning experiences for his students (Haney and Ullmer, 1970). According to Haney and Ullmer, research in audio-visual communication generally has reported significant learning gains attributable to media. In recent years, teaching machines and other related self-instruction instruments have attracted widespread attention with much of the attention focused upon the nature of the specific device as a means for instruction presentation (Lumsdaine and Glaser, 1960). Bunderson and Butts (1969) caution educators to be "concerned about the accuracy of any media and to not succumb to the attractive appearance alone." As aptly said by Dean (1971), we can prevent the media from becoming the message if the program is student oriented.

In recent years, many educators have expressed concern about the failure of many traditional methods of instruction, and emphasized individual differences in the learning abilities and rates of learning of students (Gagné, 1967). In Siegel and Siegel (1967), these concerns direct teachers towards individualization of instruction and several teaching methods have evolved (Goldschmid and Goldschmid, 1974; Edling, 1971; Gronlund, 1974). These methods range from

structured to unstructured (Norris et al., 1975). The major innovations in diverse individualized instruction strategies appear to include: Computer-Assisted Instruction (hereafter called C.A.I.), Guided Design (hereafter called G.D.), Personalized System of Instruction--Keller Plan (hereafter called P.S.I.) and audio-tutorial. A brief description will be given of each of these with an expanded description of audio-tutorial.

Probably the newest innovation in instruction is C.A.I. Although developed in the 1950s (Alpert and Bitzer, 1969; Ayers, 1980), it is still very much a frontier in education. There is considerable evidence that the C.A.I. can achieve an individualized instruction (Haser et al., 1977; Hofstetter, 1980). Early C.A.I. programs were administered through time-sharing systems. Probably the most famous and most sophisticated of these systems is PLATO (Programmed Logic for Automatic Teaching Operations), developed at the University of Illinois (Magidson, 1974a). Magidson reported a number of benefits derived by students using the system as with other C.A.I. systems: (1) it permits each student to learn at his/her own pace; (2) it can provide immediate and precise feedback, and remedial or advanced work depending on the student's performance; and (3) it provides the student with personal attention. In addition, it exhibits considerable flexibility, including

serving as text, tutor, and test. Magidson later described the application of mastery learning principles in PLATO instruction units (Magidson, 1974b).

The most recent instructional strategy designed to teach process skills is Guided Design (G.D.) (Wales and Stager, 1977). In this strategy, the skill that is carefully modeled is the use of the decision-making process. In a G.D. course, learning is organized around the students' efforts to devise solutions for a series of open-ended problems. While there is no single correct answer to any of these problems, each requires the student to put into play specific information studied outside of class as they develop a feasible solution. The teacher selects the problems according to the skills and subject matter the students are expected to use and prepares written instruction-feedback material which guides students through a "model" solution.

G.D. adds an important dimension to the learning process because it is an educational strategy that makes it possible for teachers to accomplish simultaneously two goals that have stubbornly resisted integration: teaching subject matter and developing the decision-making skills required to apply what has been learned to the solution of real-world problems. With G.D., the teacher models professional reasoning and shows students how the material they study can be used to make better decisions. An

important by-product of this process is increased motivation which improves the students' retention of the subject matter concepts they study.

When it is properly developed, G.D. satisfies a variety of psychological principles. Each, for example, satisfies the ideas developed by Skinner. And each accomplishes what Bloom (1980) said could be achieved by (1) providing quality instructional materials, (2) helping students develop the cognitive base and process skills they need to proceed successfully, (3) testing to provide feedback on learning errors before testing for evaluation, and (4) increasing guidance, cues, reinforcement, and student participation in the learning process.

The Personalized System of Instruction (PSI) is a learning-teaching system in which individual students go through the elements or units of a course of study at their own pace; with mastery required at every step; with guidance, encouragement, and provisional evaluation by selected peers; and with maximal reward upon completion of their tasks.

Like psychology, PSI has a long past but a short history. It has probably been used throughout the ages by artists, sculptors, musicians, and craftsmen, as well as countless tutors, in passing on their skills or knowledge to their pupils. The Keller Plan, as it is

popularly called, has been described as "the most revolutionary approach to college in the past fifty years" (Hoover, 1980, p. 53). It was anticipated in its modern form by teachers of the present century in the United States, in Canada, and possibly in other countries. But the PSI described had its origin in 1963, in an effort supported by the University of Brasilia, to develop a system of instruction that would be consistent with behavior science and that would make use of what was known about its application in the field of teaching.

By 1965 at Arizona State University, it took its present shape, in psychology courses taught by Gilmour Sherman and Fred S. Keller. Since then, it has been used in many other places, in a variety of disciplines, and at many levels of instruction. Numerous studies have been made of its comparative effectiveness in terms of student learning and retention. It shifts the emphasis of education to a goal of teaching for accomplishment from that of merely selecting for achievement (Bijou and Ruiz, 1981, p. 282). It does pose a problem for some faculty to adjust in their traditional role.

> They must become course designers and course managers rather than performers. They must forego the immediate gratification of lecturing for the delayed gratification of improved student performance at the end of the course (Milton et al., 1978, p. 162).

The number of articles on PSI as a teaching method now

exceeds 1000. The overwhelming majority of research studies points to its superiority over traditional teaching methods in terms of student achievements and satisfaction with course content.

In summary, individual instruction research is changing from simple comparisons between a traditional system used with one group and an individualized system used with another group, to more relevant designs in which the main concern is not to ask what kind of instruction is better but to ask what kinds of instruction are effective with what kinds of students to achieve what kinds of objectives. This kind of research is not expected to suffer from the non-significant results obtained in most of the previous research. In fact, it is quite logical to look for and find system-student interactions since one would not expect all students to do well under one system of instruction unless a panacea were created.

The Audio-Tutorial Method

S. N. Postlethwait, a biology professor at Purdue University, has been a leader in the development of the audio-tutorial approach. This system of instruction was developed to cope with the diversity of backgrounds among students (Meierhenry and Postlethwait, 1966). This approach retains important attributes such as personal contact between student and teacher in the face of rising class

enrollments while supplementing these with the use of modern communication devices to provide better learning opportunities.

The inception of the audio-tutorial approach as currently used by Postlethwait at Purdue University was in 1961. In order to provide for individual differences within the class, Postlethwait began by putting supplemental lectures on tape for use by the slower students at their convenience. The system developed from a series of taped lectures to a set of integrated experiences, including lectures, demonstrations, set-ups, experiments, movies, and other appropriate activities helpful in understanding the subject matter. By the end of the semester, a weekly learning kit was prepared and the students were able to complete a week's work without attending any of the formal session of the course. Response by the students was so favorable to this supplemental material that an experimental section of 36 students was offered all instruction programmed by audio tape. These students met once each week with the instructor for a discussion session and to take quizes. The same examinations were administered to the experimental group as the students in the lecture/laboratory classes. An evaluation of the students in both groups at the end of the semester showed no difference in their achievement. The 36 experimental students were interviewed as to how to develop a

study program in plant science which would have flexibility and continue to be a quality program. As a result of these discussions, the freshman botany course at Purdue has been restructured utilizing the audio-tutorial approach (Postlethwait et al., 1964).

In developing the new approach, the teaching assistants, students, H. Murray, J. Novak and Postlethwait combined their efforts to examine all course activities in terms of contributions to the learning process and to restructure the course accordingly. The basic guidelines were: (1) learning required involvement of the learner at a pace and time optimal for him, and (2) opportunities should be provided for repetition, concentration, multisensory exposure to subject matter, an appropriate sequencing of learning events, and interaction with fellow students and instructors. Following these guidelines required provision for flexible scheduling of a great variety of activities, with emphasis on the students' initiative (Meierhenry and Postlethwait, 1966).

Postlethwait and his colleagues completely restructured the botany course along lines of independent study exercises including laboratory experience which the student could gain at his own pace and repeat as necessary to achieve the necessary learning results. In addition to this independent study, one hour a week was set up for a

general-assembly session and one hour a week for small-group sessions where assignments could be turned in, new ones picked up, and points of general concern could be discussed by the group with an instructor. In the general-assembly session, opportunity would be provided for students to meet the senior instructor, to hear special lectures by research professors, to view long films, to gain enrichment in the subject matter covered during independent study, and to set an intellectual tone for the course (Wittich and Schuller, 1967).

The uniqueness of the audio-tutorial system of instruction lies in the fact that it both individualizes instruction and accommodates large numbers of students. Like programmed instruction, it requires that emphasis be placed on clearly defined learning behaviors rather than on teaching objectives as commonly interpreted by subject-oriented instructors. But unlike early forms of programmed instruction, the system makes use of a variety of instructional media, each according to its appropriateness to specific learning requirements. Systematic analysis is required both to specify the needs and to determine the best means for meeting them (Wittich and Schuller, 1967).

As a result of constant evaluation of the audio-tutorial botany course, a number of advantages become evident. Postlethwait (1965) summarizes them as follows:

(1) Emphasis is placed on student learning instead of teaching technology. The student receives credit for his knowledge and skill regardless of how or where it was acquired (attendance does not contribute to the grade).

(2) The study pace is under control of the student, who can repeat or omit any portion of the study program desired.

(3) Better students are not a captive audience. They are free to choose those activities which are most instructive and challenging.

(4) Study time can be arranged to accommodate the demands of other campus activities or work loads.

(5) Study conditions involved a minimum of distraction.

(6) Contact with instructors is meaningful and at a time when the student has a "readiness to learn."

(7) More students can be accommodated with less space and less staff.

(8) Students learn more in less time. Grades are higher and "feedback" from past students indicate that retention is better.

(9) Problems with make-ups are minimized.

(10) The students are treated as adults who are capable of participating in decisions concerning their study habits.

The students' response to this approach was overwhelmingly positive. The results on one unsigned questionnaire show that 96 percent of the students have a preference for the audio-tutorial system over the lecture/laboratory method. The relaxed atmosphere of independent study permits the students to explore topics of individual interest thoroughly and to master techniques and understanding before proceeding to the next item. This results in improved student performance as evidenced by overall higher grades and by student enthusiasm for the subject.

Some additional advantages which Postlethwait (1967) further suggests are:

(1) Appropriately sequences and integrates the use of printed texts and manuals, movie films, microscopes, specimens--every conventional learning event.

(2) Ideally accommodates students with a wide diversity of backgrounds, aptitudes and interests.

(3) Places the mechanics of scheduling and the responsibility for learning on the students.

(4) Leaves the teacher free for the real business of teaching--orientation, direction, elucidation, guidance, and personal contact with the individual students.

The audio-tutorial system has been in operation at Purdue since the fall of 1962. Over 5000 students have been exposed to botany through this system, and over 90

percent have indicated a preference for this approach over the conventional system in unsigned questionnaires. Postlethwait has taught general botany at Purdue for more than 25 years, and estimates that the current course contains approximately 50 percent more information than previously and the students' understanding of course content is much improved. The average amount of time spent in an Independent Study Session (ISS) per week per student for the entire semester is a little over 2½ hours, and this is in contrast with 4 hours per week spent by each student under the lecture/laboratory system (Meierhenny and Postlethwait, 1966). The result of the audio-tutorial approach as reflected in the performance of the students during the past four years has been improved learning at all levels. Grades of A increased from 7 to 22 percent, B grades from 20 percent to 35 percent, and failures have decreased from 20 to 7 percent (Postlethwait, 1966a).

Students vary widely in the time they require to master a given body of knowledge. In a preliminary study (Postlethwaite et al., 1964) of differences in information acquisition rates for botany students, it was found that time spent in the audio-tutorial booth was related to the total scores on tests of botanical knowledge. However, the relationship was much more striking when the ground under study was divided according to analytic ability, i.e.,

students scoring in the upper, lower and middle thirds on a test of analytic ability were treated as distinct groups. It was noted that hours of study in the audio-tutorial booth, a principal learning experience for most students, show a positive correlation with the score on a 100 item test of botanical factual knowledge. However, when grouped by analytic ability, it can be seen that knowledge gained by the middle analytic group was greater for a given amount of study time and knowledge scores for the high analytic group were higher than for the lower two groups, with mean scores for high analytic group working in the booth only 9 hours in a 5-week period exceeding the mean scores for students in the middle analytic group working for 20 hours in the same period.

Each instructor must consider his objectives and evaluate his procedures in each lesson prepared for a course. The audio-tutorial system forces an instructor to spend a great deal of time in planning the preparation of each lesson. Postlethwait (1966b) suggests seven steps in the preparation of the audio-tutorial lesson:

(1) "List all of the objectives of the unit." The teacher should list the possible achievement which he expects the students to accomplish.

(2) "List all of the available media and teaching aids which might be useful in accomplishing the above

objectives." These include all items that might be useful in this regard such as: exercises to be completed from a manual, films to be viewed, homework problems to be completed, etc.

(3) "Select the media adapted to the subject." List alongside the items to be accomplished the method through which they can best be done.

(4) "List the study activities in their proper sequence." Align each item in a properly programmed sequence.

(5) "Assemble the materials to be programmed by the audio tape." This should result in the production of a trial tape.

(6) "Have the audio tape transcribed and edited critically." This step enables the instructor to make sure the words he uses express precisely the information he wishes to present and to eliminate much of the redundancy which occurs in ordinary conversation.

(7) "Make the final tape." The final tape may be best made from a manuscript which has been edited (see Appendix I).

While it is true that there is much to discover about the learning process, we should consider the sequencing of learning events with each objective identified and as by the nature of the subject matter. Postlethwait (1966b) summarizes his feelings about the approach to teaching as he states:

> Education is a science, and one may begin as with any other problem by clearly defining the problem first. Once the problem is defined, the solution is often evident. Basically the problem is to help the learner learn, and since learning must be done by the learner, one should design all activities to require involvement of the learner with a total focus on what objectives are to be achieved, the facilities available to achieve these, and how this person as an individual can best approach or grow to acquire the desired characteristics. If audio is eliminated as a pathway, the many other facilities and communication devices must be exploited (p. 660).

Related Research and Ongoing Audio-Tutorial Projects

To date, there have been four reviews of research on the effectiveness of the audio-tutorial method. The first of these was an unpublished report, made in 1970 by the Research Office of Diablo Valley College on the audio-tutorial practices in California community colleges. Through the use of a questionnaire, they surveyed 91 California community colleges and 25 other junior colleges elsewhere in the United States to determine the extent of their involvement with the audio-tutorial method, their opinions on its effectiveness, and how the instructors viewed it.

Their conclusions were that students learned more and were enthusiastic toward the method after experiencing both the lecture and the audio-tutorial method; and despite the large amount of work required for instructors to prepare audio-tutorial instruction, they were enthusiastic about the method and the opportunities presented for more

individualized, personal contact than they had in lecture/ laboratory courses (Audio-Tutorial Practices in California Community Colleges, 1970).

The second was a brief review published in 1975, which included 14 doctoral dissertations and 5 other research studies in the sciences and mathematics. Mintzes identified three types of studies: comparative studies of the audio-tutorial method with some other instructional method; studies of the relationship between certain student characteristics and performance in audio-tutorial courses; and studies of unrelated instructional variables and performance in audio-tutorial courses (Mintzes, 1975).

Of the seven studies which were comparisons of the audio-tutorial method with some other method, a significant difference was found in three cases favoring the audio-tutorial method; in one case, there were significant learning gains for the audio-tutorial method, but there was no control group; in one case, there was a significant difference in learning in favor of the conventional method; and in two cases, there was no significant difference between the methods. Characteristics such as personality, attitudes, and biographical variables were not significant predictors of performance, but intelligence and aptitude were shown to be significant positive predictors of performance in studies on student characteristics.

The third review by Kathleen M. Fisher and Brian MacWhinney, published in 1976, included 89 studies, covering the period from 1962-1975. Of this total, 44 studies were comparisons of achievement of the two groups enrolled in the same or similar courses who were exposed to an "autotutorial" method and to a traditional method, and 27 studies were on student attitudes. The remaining 18 dealt with various aspects of audio-tutorial instruction including predictors of achievement, effects of individual portions of the instructional method, time required for learning, cost studies, etc. (Fisher and MacWhinney, 1976).

Of the 44 comparative studies, 30 favored the audio-tutorial method, one favored the lecture method, and 13 found no significant difference between the two methods. Of particular interest to this investigator were the 37 studies at the college level. Twenty-five were in various fields of the sciences; of these, seventeen favored the audio-tutorial method, one favored the lecture method, and seven showed no significant difference between the methods of instruction. The nonscience studies at the college level, 12 in number, included one study each in accounting, algebra, American history, atomic bonding, business machines, industrial engineering, law, shorthand, teaching machines, USAF academic instructor course, use of

audiovisual materials, and Western civilization. Nine of the nonscience studies favored the audio-tutorial method and three showed no significant differences in terms of learning gain between the methods.

These nonscience studies included a variety of techniques. Those which favored the audio-tutorial method included compressed speech tape compared with lecture; audiovisual instruction on operation of business machines compared with conventional instruction; film-tape instruction of shorthand diction; and use of a 160-item pretest-posttest on the use of audio-visual materials in teaching, compared with conventional methods.

Fisher and MacWhinney indicated that:

> Student achievement on written examinations with audio-autotutorial (A-T) instruction nearly always equals, and usually exceeds, that obtained with the conventional method of instruction. . . . Only one of 44 comparisons reviewed here favors the lecture method of instruction, while more than two-thirds attribute superiority to the audio-autotutorial approach (Fisher and MacWhinney, 1976, p. 251).

Many of the comparative studies also included portions on students' attitudes toward the method; the proportion of students preferring the audio-tutorial method was high. In other studies, statements about student opinion included comments such as "almost universally favorable" and "overall, about 85 percent of the students prefer the audio-tutorial method."

Students' attitudes toward specific components of the audio-tutorial method were also studied. Those components which were most valued by students were self-pacing, mastery grading, independent study, and group study; the least valued was the general assembly session.

The greatest appeal of the audio-tutorial method has been to those in the sciences, but as shown in Fisher and MacWhinney's review, more investigators, in a wide variety of subject areas, have undertaken use of the method with encouraging results.

The fourth and most current literature review examines instructional improvement since 1978. Charles C. Cole, Jr. (1982) in his review concludes that theorists agree generally that: learning is enhanced when the student is active rather than passive; learning is improved by practice and feedback; learning is improved when directed toward some goal; learning has both an affective and cognitive aspect; and the quantitative and qualitative differences in the learning process are great.

Cole's review reflects that current literature is rich in information about the wide variety of instructional methods presently employed in colleges and universities. Cahn (1978), Centra (1977), Eble (1980), Gaff (1978), Kozma et al. (1978), and Milton et al. (1978) provide useful summaries of methods from lecture to discussion, from

seminar to simulation. Although at least 70 percent of undergraduate teaching still relies on the lecture method (Mandell, 1977; Berquist and Phillips, 1977), educators report an increased interest in new teaching techniques, especially those involving the individualization of instruction and those that respond to the more diverse student body served by higher education in the 1980s. Experts also report an increased interest in the personal aspects of learning, reflecting the extensive attention given to adult development.

Friedlander's report on teaching practices in the sciences reflects the combination of the traditional and the innovative. According to a 1977 national survey of science teachers in community colleges, 94 percent used the lecture method 81 percent class discussion, 46 percent media, 25 percent students' verbal presentations, 10 percent field trips, and 10 percent simulation/games (Brawer, 1980).

The different teaching methods currently used can be conceptualized in several models. One might classify them in terms of the learning or instructional theories on which they are based or on the basis of control by the instructor or by the student. They might be classified according to whether they focus on the cognitive or affective aspects of learning. The most useful division appears to be one used

by Berquist and Phillips (1977), which organizes teaching methods into three major classifications--content-based, student-based, and interaction-based.

Those who focus primarily on subject matter, especially the behaviorist school, use content-based teaching methods. The student-based methods seek to respond to the learner's needs and interests, with the instructor less in control and the student playing a dominant role in identifying outcomes. The interaction-based methods reflect the assumption that learning occurs primarily through the give-and-take between teacher and student, student and student, or student and experience. These methods devote more attention to the instructional setting than to coverage of a particular amount of information (Berquist and Phillips, 1981).

The newest area, relatively undeveloped, is the use of computers. The availability of computers makes possible independent research projects (Benedict and Butts, 1981). Widespread acceptance of microcomputers, which are complete systems operating in a self-contained unit, is predicted. Microcomputers are already popular in computer science, engineering, and physics courses. According to a 1979 study, at some institutions the amount of instruction by microcomputers had already exceeded that provided to students by centralized computers. It is claimed that microcomputers

will have great impact, as a tool for students' learning and on the role of the professor.

> The advantage which the professor holds over the student in terms of knowledge and skills. . . will be reduced. Students will access more information directly than has been possible with book formats (Zinn, 1980, p. 122).

Between 1978 and 1980, more than 100,000 microcomputers were sold. According to one estimate, in the very near future the number of microcomputers in use will be in the millions, and a large proportion of institutions will be using personal computers in their educational programs (Lewis and Tagg, 1980).

For some, computers seem to pose a threat, but to others they open new vistas of potential for extending and improving instruction. According to a view that is becoming more widely accepted, "The increasing technological sophistication of our society requires that people learn more complicated subject material and skills and perform those skills at higher standards of performance" (O'Neil, 1981, p. xi).

Summary

The review of literature has been conducted to improve understanding and appreciation for the complexities and implications for change involved in education in general and the teaching of physical education in particular. We

cannot expect the audio-tutorial approach to have a significant impact on instructional practices or procedures until there is less resistance to change from the dominant lecture/lab approach. It appears that a breakthrough is imminent due to the large number of schools trying to utilize different approaches.

Only one study was found in the field of Physical Education. The study was completed in a Human Physiology class (Keeney, 1975).

This current study attempts to evaluate the potential of audio-tutorial, and the other materials provided for students enrolled in weight training, football officiating, archery, and skiing at Iowa State University, and used in the audio-tutorial system of instruction on their own time, considering their individual abilities and backgrounds. In the opinion of the authors cited, the audio-tutorial system holds great promise in the production of a system of truly individualized learning.

CHAPTER III. METHODS AND PROCEDURES

Audio-tutorial materials were developed for use in teaching physical education classes at Iowa State University. This investigation will evaluate the relative effectiveness of the two methods, audio-tutorial and lecture/lab, for instruction of Iowa State University students in weight training, football officiating, skiing, and archery, and to evaluate the quality and efficiency of those materials in teaching those courses.

This chapter describes the methods and procedures that were used to gather and analyze the required data for the study. The chapter has been divided into five parts: (1) Selection of a population for the study; (2) preparation of the materials; (3) class management and experiment execution; (4) testing; and (5) treatment of the data.

Selection of the Population

Two categories of students participated in the present study: (1) students preparing for a professional career in the field of health, physical education, and recreation; and (2) students taking the class as an elective course; through the Department of Physical Education and Leisure Studies. The curriculum in the Department of Physical Education and Leisure Studies is planned for students preparing to teach physical education or preparing to enter related

professional areas. The student majoring in physical education may select one of eight options: (1) physical education secondary certification (7-12); (2) physical education secondary and elementary certification (K-12); (3) dance; (4) exercise science; (5) athletic training; (6) sport studies; (7) health related studies; or (8) general physical education studies. The Office of University Recreation Services program is planned to provide quality recreational opportunities for the campus community. Programs include intramural sports, sports clubs, open recreation, outdoor recreation, special events, and recreation facility scheduling. Many physical, cultural, and social recreation programs are sponsored in coordination with various departments, organizations, and groups on and off campus. This includes formal and informal noncredit course instruction.

Students at Iowa State University preclassify in advance for courses. Due to the nature of this process, it was not feasible in one semester to attempt to randomize the students into subgroups for treatment and for testing. The four courses and the dates which they were offered were: weight training - summer 1983; football officiating - fall 1982; skiing - winter 1978; and archery - summer 1978. Canoeing, which was offered in the summer of 1978, was eliminated from the study. It was not feasible to offer a

control-experimental group design because of low enrollment.

The control and experimental sections were assigned to the classes on a random basis. Table 1 shows the comparative frequency data based on sample size.

Table 1. Frequency table for sample size

Subject area	Class size	Audio-tutorial	Lecture/lab	Male	Female
Weight training	44	24	20	31	13
Football officiating	25	12	13	24	1
Skiing	34	14	20	22	12
Archery	21	10	11	14	7
Totals	124	60 (48.4)[a]	64 (51.6)	91 (73.4)	33 (26.6)

[a]Total percentages are in parentheses.

The sample size was 124; 60 (48.4 percent) were in audio-tutorial sections and 64 (51.6 percent) were in the traditional lecture/lab sections. The sample contained 91 males (73.4 percent) and 33 females (26.6 percent). Weight training was the largest class, with 24 students in the audio-tutorial section and 20 in the lecture/lab section. Skiing was the second largest class, with 14 students in the audio-tutorial section and 20 in the lecture/lab

section. Football officiating was the third largest, with 12 students in the audio-tutorial section and 13 students in the lecture/lab section. The smallest class was archery, with 10 students in the audio-tutorial section and 11 students in the lecture/lab section. Even though one lecture/lab skiing student fractured an ankle after completing the final run, all original students completed the course.

Preparation of the Materials

The opportunity to view other audio-tutorial programs in operation was presented through the Audio-Tutorial Congress Conference at Purdue University in 1971 and at the University of South Carolina in 1972 (see Appendix A). As a result of these experiences, the potential of audio-tutorial usage in physical education and recreation at Iowa State University was explored. In 1973, the Iowa State University Council on Instruction awarded the researcher an Innovative Teaching Grant to assist in the development of an Audio-Tutorial Systems Approach to Recreational Learning (see Appendix B). The initial phase included the packaging of noncredit minicourses using tapes, slides, film loops, video tapes, and other visual material. Minicourses included: camping, backpacking, sports officiating, golf, skating, skiing, archery, tennis, canoeing, and

sailing. Several of these minicourses were then refined and made available for credit when the need for an alternative method of instruction was shown.

Specific details for preparation of materials for each of the experimental courses were similar. The course outline and objectives for audio-tutorial and lecture/lab methods were the same within each subject area (see Appendix C).

In the audio-tutorial classes, a script, which roughly outlined the course, was utilized for planning each sequence of activities. The script was handwritten on individual pages of paper. Each page was three columns wide. The first column was a rough drawing of the picture the student would see on the projection screen. The second column was a description of the sound that the student would hear through the earphones while watching the slides shown in sequence. Column three contained the written narration which was placed either on tape or on written materials contained in the learning package (see Appendix D).

Several university services were used for material preparation and student access. All tape recording, tape duplication, and sound and slide synchronization were done at the Media Resource Center. Iowa State University Photo Service and Media Graphics assisted with all slides, prints,

and visual aids included in the package. Iowa State University Library Microforms and Media Center coordinated student use of the audio-tutorial packages for all four courses. Students obtained a self-contained learning package by presenting a current student identification card. Approximately 40 individual stations were available in the learning center. Qualified library personnel were readily available in the event any equipment malfunctioned (see Appendix E).

Class Management and Experiment Execution

Weight training classes were conducted in the weight room area of Beyer Hall. The audio-tutorial and lecture/lab sections were provided with a large group orientation session during the first and second class meetings. The course outline was reviewed in detail. The method of recording lifts, attendance frequency, attendance duration, and the first half of the pretest lift were administered. During the second class meeting, the second half of the pretest lift and the written pretest were administered. The audio-tutorial section received additional instruction on location and utilization of the audio-tutorial packages. Through the final week of the course, the lecture/lab section met each week during their regular class time for lectures and lifting routines. The audio-tutorial section

reported during their class time only once per week to submit lift and attendance records (see Appendix F). The final two class meetings were the same for both sections with a supervised final lift and a supervised written final exam.

Football officiating classes were conducted in room 203 Beyer Hall and on the recreation fields. The first and last classes of each instructional method were large group meetings. Content of the meetings was the same. It included orientation, supervised written pretest, and supervised written final exam. The audio-tutorial section received additional instruction on location and utilization of the audio-tutorial packages.

Skiing classes were conducted in room 203 Beyer Hall and Ski Valley, Boone, Iowa. The first class meeting was a large group meeting for orientation. The lecture/lab section met during the classtime and received the traditional type of instruction. The audio-tutorial section performed the skills contained in the learning package and were able to progress and receive advice based upon their individual ability level. Supervised final written exams were administered to both sections in a large group setting.

Archery classes were conducted in the Physical Education Building and on outdoor recreation fields (when weather was favorable). The first and last class meetings

were large group orientation and supervised final exam administration. Due to the nature of the course and the departmental process of equipment check out, students in each section met only during their assigned class time. Although audio-tutorial students had the flexibility to practice as long as they wished within their class time, they were required to stay only until they showed the minimal mastery skill level.

Testing

Weight training and football officiating students received supervised written pretests and final exams. Skiing and archery students received a supervised written final exam only. Weight training students received supervised pretest and final lifts. Archery students received supervised pretest and final target scores.

All audio-tutorial students were given an expanded I.S.U. Government of the Student Body questionnaire to survey their attitude toward the teaching approach. They were also asked through an open-ended question to give their impressions of the audio-tutorial system (see Appendix H).

Personal data on each student were collected through the registrar's office. All students who participated in the study signed permission slips (see Appendix G).

All cognitive exams were processed by the Iowa State University Testing and Evaluation Service. All course examination answer sheets were processed on optical scanning machines and the data were analyzed. Services included: the scoring of the answer sheets; the statistical analysis of the scores and of the individual items; a listing of the score results by name and by student number; and the maintenance of the score and item analysis data for future use. The reliability estimate and the error of measurement served as the indications of the overall reliability of the test (see Table 2).

Exam scores and information on age, sex, weight, lifts, skill evaluation, target scores, attendance frequency, attendance duration, grade point average, high school rank, pretest scores and final exam scores were coded on data cards for each student. Each student was assigned a number to protect confidentiality. Statistical analysis was then performed using the SPSSX statistical package available through the Iowa State University Computation Center.

Pretest and posttest scores were obtained for weight training and football officiating. Posttest scores only were obtained for skiing and archery. For statistical analysis, only the combined scores were used. The reliabilities were considered sufficient to proceed with further analysis of the data.

Table 2. Pretest and posttest score characteristics for audio-tutorial and lecture/lab classes

Class	Section	Reliability	Average test scores	Error variance	S.E. of M. raw score	S.E. of M. test score
Weight training	Pretest	.56	63%	8.98	3.00	66.17
	Posttest	.71	75%	6.35	2.52	53.48
Football officiating	Pretest	.74	71%	16.43	4.05	51.32
	Posttest	.73	82%	12.09	3.48	52.10
Skiing	Posttest	.71	72%	8.03	2.83	53.60
Archery	Posttest	.69	69%	9.08	3.01	55.77

Treatment of Data

The primary goal of the investigation was to evaluate the relative effectiveness of the audio-tutorial method of instruction as compared to the lecture/lab method. Measurement was by post-course physical education achievement tests, adjusting for differences with respect to achievement pretests, high school rank, or grade point average. A secondary goal was to determine any differences in the effectiveness of the two instructional methods within subject areas in regard to selected variables. Variables selected in weight training were weight room attendance frequency, weight room attendance duration, pounds lifted, and student body weight change. The variable selected in football officiating was an on-the-field football officiating skill evaluation. The variable selected in archery was target score improvement. There were no secondary variables in skiing.

A preliminary analysis using Pearson Correlation investigated the relationships among all the background variables, the ability variables, and the student's test scores.

A t-test indicates whether any significant differences exist between means. A t-test was chosen as the appropriate statistical tool to determine any significant difference

between the means of the final exam scores with regard for the background variables for weight training and to determine any significant difference between the means of the post test scores with regard for method of instruction for weight training, football officiating, skiing, and archery.

Analysis of variance (ANOVA) tests the null hypothesis that the group means of the dependent variable (achievement) are equal. Analysis of covariance (ANCOVA) is similar to the ANOVA, except that the influence of one or more independent variables on the dependent variable is controlled.

Stepwise regression was carried out to investigate the importance and identification of variables in predicting score and to identify those variables.

The responses to a student questionnaire were reviewed. The primary purpose of this review was to describe the audio-tutorial materials and to discuss a basis for future use of these materials (see Appendix H).

The study was conducted with two significant levels. Level of significant ($p = .05$) indicated that the probability of committing a Type I error (rejection of null hypothesis when it is true) was only 5 percent. Level of significance ($p = .01$) indicated that the probability of committing a Type I error was only 1 percent.

CHAPTER IV. FINDINGS

Introduction

The findings of this study were based upon the results obtained by testing 124 students in four physical education classes at Iowa State University. A review was made of responses to a questionnaire completed at the end of the experiment.

The purpose of Chapter IV is threefold: (1) first, to present preliminary findings using a frequency table for sample variations, using a Pearson Correlation matrix, and using t-score tables; (2) second, to present an analysis of data using analysis of variance tables, using analysis of covariance tables and using Step-Wise Regression equations; and (3) third, to review student attitudes based on their responses to a questionnaire distributed at the end of the course. The chapter was organized under the following headings: Preliminary Findings, Analysis of Data, and Review of Student Questionnaire. The Statistical Package for the Social Sciences (SPSSX) was used as the statistical program.

Preliminary Findings

Frequency tables provide us with basic background information on our sample and other associated variables

Frequency tables for sample variables

According to Table 3a, the student high school rank had a range from the 1st through the 93rd percentile. The

Table 3a. Socio demographic characteristics of all students

Variable	Mean	Standard deviation	Minimum	Maximum
High school rank	32.33	20.54	1	93
Age	21.46	2.64	17	36
Year in school	2.69	1.31	1	6
Grade point average	2.51	.68	.73	4.0
n = 124				

mean (32.33) indicates that most students at Iowa State were from the upper half of their graduating class. Age varied from 17 to 36, with a mean of 21.46. Most students were upper classmen and women. The range of students is broken down further in the questionnaire discussion. Grade point average was a freshman year grade point average score ranging from a low of 0.73 to a high of 4.0 on a 4.0 scale. The mean grade point was 2.51, which is consistent with other students at Iowa State University.

The results of Table 3b show that on the precourse test for the weight training sample, scores ranged from 21 to 44 with the mean of 31.73, while on the final exam the range was from 25 to 47 with a mean of 37.49. The students' overall achievement did improve. Students lifted weights an average

Table 3b. Weight training characteristics

Variable	Mean	Standard deviation	Lowest total	Highest total
Precourse test score - 50 items	31.73	4.53	21	44
Final exam - 50 items	37.49	4.71	25	47
Attendance frequency - days	18.02	2.64	11	24
Attendance duration - minutes	55.91	8.88	30	70
Total lift improvement - lbs.	271.59	108.76	90	615
Body weight change - lbs.	2.25	2.95	0	15

n = 44

of 18 days (18.02) which works out to be 3 times per week. If a student worked out every other day, a total maximum would have been 24. Students stayed in class while lifting weights an average of 56 minutes (55.91). There was no limitation in this area, but the maximal time was 70 minutes. The class average in lift improvement (271.59 lbs.) indicated that students were able to lift more at the end of the course than they were able at the beginning of the course. The average change in body weight was 2.25 lb. It should be kept in mind that comparing males to females might be better done by percentages than pounds due to differences in overall size.

Improvement on tests at the start of the course to the end of the course were 9 points (Table 3c) on minimum

Table 3c. Football officiating characteristics

Variable	Mean	Standard deviation	Lowest total	Highest total
Precourse test score - 100 items	71.48	5.64	59	83
Final exam - 100 items	82.19	5.94	68	92
Football officiating skill evaluation - 50 points n = 25	32.64	3.37	25	40

score and 9 points on maximum score. The average improvement, however, was less than 3 points (71.48-82.19). Out of a possible 50 points, an average of 32.64 points were achieved on skill evaluation, with the worst score 25 and the top score 40.

The least amount of data was collected on skiing. Students' cognitive knowledge (final exam) showed a mean of 36.09 with a range from 17 to 45 on a 50-item exam (see Table 3d).

Table 3d. Skiing characteristics

Variable	Mean	Standard deviation	Lowest total	Highest total
Final exam - 50 items n = 34	36.09	5.29	17	45

Students in archery improved according to Table 3e. Average shooting scores improved from 53.33 to 134.76 out

Table 3e. Archery characteristics

Variable	Mean	Standard deviation	Lowest total	Highest total
Final exam - 60 items	41.52	5.40	33	54
Precourse score - 200 possible	53.33	18.93	30	100
Final score - 200 possible	134.76	33.63	80	185
Archery score improvement n = 21	81.43	32.45	20	140

of a possible 200 points. The lowest score increased by 50 points (30-80) although the class average improvement was only 20 points. The high final score improved 85 points although the class average was 140. It would be difficult although interesting to speculate which students improve the most and why. The low n makes this a difficult analysis. Achievement results of the final exam showed an average grade of 41.52 on a 60-item test with scores ranging from a low score of 33 to a high score of 54.

The Pearson correlation coefficient (r), which was computed by the Pearson Corr procedure in SPSSX, serves a dual purpose. Besides its role as an indicator of the goodness of fit of the linear regression, it is going to be used

as a measure of association indicating the strength and direction of the linear relationship between the two variables. If the value of r is close to zero, it can be assumed that there is little or no linear relationship between the two variables. If the value of r approaches +1.0 or -1.0, we can assume there is a strong linear relationship. The term r^2 is a measure of the proportion of variance in one variable explained by the other. Often, there may not even be interest in the prediction or the regression line itself. Rather, one may wish only to know the strength of the relationship or to obtain the correlation coefficient for other statistical purposes. Tables 4, 5, 6, and 7 show variable relationships in the four physical education classes.

Table 4 shows that the relationships at the significant level (p = .05) were: method of instruction with grade point average (.29), body weight change (.30), and post test body weight (.28); sex with grade point average (.28) and age (.25); high school rank with attendance duration (.33) and post test score (.31); grade point average with age (.32), pretest score (.25), final exam score (.30), posttest weight lifted (.33), and pre- (.28) and posttest body weight (.30); age with pretest lift (.26).

Relationships at the highly significant level (p = .01) were: method of instruction with attendance frequency (.55)

Table 4. Pearson Correlation Matrix for weight training (n = 44)

	Method of instruction	Sex	High school rank	Grade point average	Age	Year in school	Attendance frequency
Sex	.19						
High school rank	.16	.21					
Grade point average	.29*	.28*	.56**				
Age	.03	.25*	.04	.32*			
Year in school	.14	.05	.12	.47**	.40**		
Attendance frequency	.55**	.11	.33**	.35**	.11	.11	
Attendance duration	.54**	.22	.33*	.36**	.13	.12	.95**
Total lift improvement	.17	.35**	.19	.04	.09	.03	.16
Body weight change	.30*	.03	.17	.05	.04	.04	.18
Pretest score	.03	.03	.36**	.25*	.05	.09	.45**
Final exam score	.20	.00	.31*	.30*	.05	.10	.88**
Pretest lift	.07	.44**	.21	.37**	.26*	.11	.04
Posttest lift	.05	.60**	.11	.33*	.19	.12	.10
Pretest body weight	.22	.59**	.15	.28*	.07	.04	.02
Posttest body weight	.28*	.63**	.21	.30*	.06	.01	.03

*Significant at .05 level.
**Significant at .01 level.

Attendance duration	Total lift improvement	Body wt. change	Pre-test raw score	Final exam raw score	Pre-test lift	Post-test lift	Pre-test body weight
.05							
.19	.10						
.40**	.00	.02					
.82**	.21	.11	.57**				
.02	.08	.01	.21	.01			
.04	.42**	.04	.17	.10	.84**		
.01	.18	.03	.13	.11	.60**	.67**	
.05	.19	.05	.11	.09	.58**	.65**	.97**

attendance duration (.95) and pre- (.45) and final exam (.88) score; attendance duration with pre- (.40) and final exam (.88) score; attendance duration with pre- (.40) and final exam (.82) scores; total weight lift improvement with posttest weight lifted (.42); pretest score with final exam (.57) score; pretest weight lifted with posttest weight lifted (.84), and pre- (.60) and posttest (.58) body weight; posttest weight lifted with pre- (.67) and posttest (.65) body weight; pretest body weight with posttest (.97) body weight.

The relationship that stimulated the most interest was method of instruction and student attendance frequency and duration. It would seem to make sense that if a certain method of instruction influences attendance, that attendance may influence other variables such as quantity and quality of education.

Since two of the four courses (skiing and archery) did not have a pre-course exam, a significant relationship between high school rank and pretest score (.36) and grade point average and pretest score (.25) does exist. The relationship allows further analysis substituting high school rank and grade point average for pretest scores.

Most other relationships were common sense. Females do not lift as much as males. Older students are upperclassmen generally. Students who do better in the pretest

exam do equally better than other students in the final written exam. Students who weigh more at the beginning of a course generally weigh more at the end of the course.

Method of instruction did not have a significant relationship with students' total weight lift improvement. Method of instruction did not have a relationship with final course exam grades. These two categories have the most visibility for students and faculty. Students want good grades and they can achieve this by taking a course in which the method of instruction helps them lift more than students in other courses and achieve more on written exams than students in other courses. Faculty appear to be more motivated to work with courses in which the method of instruction causes students to excel.

According to Table 5, relationships at the significant level ($p = .05$) were: method of instruction with age (.37), and pretest score with football officiating skill evaluation (.35). Relationships at the highly significant level ($p = .01$) were: method of instruction with football officiating skill evaluation (.69), high school rank with grade point average (.53), age with year in school (.76), pretest score with final exam score (.51), and football skill evaluation (.35), and final exam score with football officiating skill evaluation (.67).

A significant relationship between pretest score and

Table 5. Pearson Correlation Matrix for football officiating (n = 25)

	Method of instruction	Sex	High school rank	Grade point average	Age	Year in school	Pre-test score	Final exam score
Sex	.21							
High school rank	.19	.28						
Grade point average	.12	.25	.53**					
Age	.37*	.18	.02	.06				
Year in school	.08	.16	.17	.05	.76**			
Pretest score	.02	.08	.08	.02	.09	.17		
Final exam score	.03	.20	.19	.33	.02	.15	.51**	
Football skill evaluation	.69**	.27	.02	.09	.31	.13	.35*	.67**

*Significant at .05 level.
**Significant at .01 level.

final exam score, as shown by the Pearson Correlation, indicates that students achieving high grades at the start of the course may receive high grades in the final exam. High school rank and grade point average did not significantly relate to pretest score. Method of instruction has a relationship on football skill evaluation. This was an important factor in the total course effect on the student.

According to Table 6, relationships at the significant

Table 6. Pearson Correlation Matrix for skiing (n = 34)

	Method of instruction	Sex	High school rank	Grade point average	Age	Year in school
Sex	.12					
High school rank	.12	.43**				
Grade point average	.11	.30*	.51**			
Age	.22	.12	.28	.18		
Year in school	.10	.15	.30*	.32*	.77**	
Final exam score	.17	.26	.20	.10	.17	.08

*Significant at .05 level.
**Significant at .01 level.

level (p = .05) were: sex of student with grade point average (.30), high school rank with year in school (.30); and grade point average with year in school (.32). Relationships at the highly significant level (p = .01) were: sex of student with high school rank (.43); high school rank with grade point average (.51); and age with year in school (.77).

Most relationships would be common sense. Those with a higher high school rank also had a higher grade point average. Older students were generally upperclassmen. The relationship that was surprising was sex of the students with high school rank and student grade point average.

Skiing would be unique if this were the only course in which this relationship existed. Method of instruction did not show a significant relationship with final exam score. A possible consideration would be that skiing may be more of a social sport than the other courses.

Based on Table 7, relationships at the significant level ($p = .05$) were: method of instruction with year in school (.46), high school rank with archery posttest hits (.48), grade point average with final exam score (.38); and year in school with archery pretest hit score (.46). Relationships at the highly significant level ($p = .01$) were: method of instruction with archery pretest hits (.58), high school rank with grade point average (.71), grade point average with archery posttest hits score (.51); age with year in school (.78), archery score improvement with archery final exam score (.46), and archery posttest hits score (.84), and final exam score with archery posttest hits score (.87).

Method of instruction did not have a significant relationship with archery score improvement, archery final hit score, or final exam. The students that had higher grade point averages did do better in total archery score at the end of the course. Although method of instruction did not have a direct effect on archery score at the end of the course, it may have had an indirect effect. Archery score

Table 7. Pearson Correlation Matrix for archery (n = 21)

	Method of instruction	Sex	High school rank	Grade point average	Age	Year in school	Archery score improvement	Final exam score	Archery pre-test hits
Sex	.07								
High school rank	.13	.09							
Grade point average	.36	.27	.71**						
Age	.26	.10	.10	.25					
Year in school	.46*	.03	.05	.28	.78**				
Archery score improvement	.29	.03	.30	.36	.08	.13			
Final exam score	.14	.05	.27	.38*	.17	.02	.96**		
Archery pre-test hits	.58**	.04	.34	.28	.36	.46*	.23	.09	
Archery post-test hits	.05	.01	.48*	.51**	.29	.13	.84**	.87**	.34

*Significant at .05 level.
**Significant at .01 level.

at the end of the course had a highly significant relationship with archery score improvement and final exam score. Possible reasons for this may be associated with the difference in learning style of the two methods. The audio-tutorial method appears to be less stressful and gives the students more flexibility. This indirect contribution could be of future interest.

The t-test is a statistical tool used to establish whether or not a significant difference in the means between two groups exists. It is indicative of or signifying a true difference between groups. If the magnitude of t is 1.96 or larger, it indicates that the difference between means is significant at the .05 level. If the magnitude of t is 2.33 or larger, it indicates that the difference between the means is highly significant at the .01 level (Borg and Gall, 1983). Table 8 shows the means and t-values in the weight training class.

The results of Table 8 show us that the students using the audio-tutorial method had significantly higher grade points than those using the lecture/lab method of instruction ($t = 2.00$). Their body weight change during the course was significantly greater ($t = -2.02$). Students in the audio-tutorial section lifted weights more frequently than those in the lecture/lab section ($t = 4.28$) and also for a significantly longer duration ($t = 3.92$). High school

Table 8. t-test for weight training

Variable	Audio-tutorial mean (n=24)	Lecture/lab mean (n=20)	t-value
High school rank	26.42	32.65	1.03
Grade point average	2.58	2.14	2.00*
Age	22.13	21.95	0.18
Year in school	3.38	3.0	0.92
Attendance frequency	19.33	16.45	4.28**
Attendance duration	60.25	50.70	3.92**
Total lift improvement	255.00	291.50	1.11
Body weight change	3.04	1.30	2.02*

*Significant at .05 level.
**Significant at .01 level.

rank, age, year in school, and total lift improvement did not show any significant relationship. Table 9 shows the means and t-values for the four physical education classes.

Table 9. t-test for all courses for cognitive final exam score

Class	Audio-tutorial mean	Lecture/lab mean	t-value
Weight training	38.42 (n=24)	36.60 (n=20)	1.30
Football officiating	82.00 (n=12)	82.38 (n=13)	0.15
Skiing	37.14 (n=14)	35.35 (n=20)	0.96
Archery	42.30 (n=10)	40.82 (n=11)	0.60

As shown by Table 9, no significant differences in the means of instructional method, audio-tutorial and

lecture/lab, were found for weight training, football officiating, skiing, and archery. It would seem, based on the review of literature, that at least one of the four classes would have shown a difference in cognitive gain since the subject areas are so diversified.

Summary of preliminary data

The method of instruction was not significantly related to final exam scores (achievement) for any class using the Pearson Correlation Matrix and t-scores. In weight training attendance duration and attendance frequency, both had a highly significant relationship with method of instruction. Grade point average and student body weight change had a significant relationship with method of instruction. The two analyses, Pearson correlation and t-score, were consistent with one another. The results of the two preliminary analysis will give a basis for analysis of covariance and regression analysis. Taking into account the fact that audio-tutorial students had flexibility in their classes, further analysis controlling different variables may provide information in comparing the audio-tutorial method with the lecture lab method.

Analysis of Data

Analyses of covariance (ANCOVA) as described in Chapter III were to be used to reject or fail to reject each

hypothesis as outlined in Chapter I. Tables 10 through 23 are directed towards testing each hypothesis.

Table 10. ANCOVA for weight training achievement

Variable	df	F
Covariate		
Pretest score	1	21.28**
Main effect		
Method of instruction	1	2.15
Explained	2	11.72**
n = 44		

**Significant at .01 level.

Data in Table 10 show that pretest score has a highly significant effect on final exam score (F = 21.28). The method of instruction has no significant effect; therefore, the analysis fails to reject the null hypothesis that method of instruction does not affect achievement for weight training. Regardless of method of instruction, students who achieve well on a pretest also achieve well on the final exam.

In Table 11, pretest score has a highly significant effect on final exam score (F = 7.68). The method of instruction has no significant effect; therefore, the analysis fails to reject the null hypothesis that method of

Table 11. ANCOVA for football officiating achievement

Variable	df	F
Covariate		
Pretest	1	7.68**
Main effect		
Method of instruction	1	0.05
Explained	2	3.86*
n = 25		

*Significant at .05 level.
**Significant at .01 level.

instruction does not affect achievement means for weight training. Similar to weight training, it would appear that most students who do well on the pretest also do well on the final exam using either method of instruction.

The Pearson Correlation Matrix shows a significant relationship between pretest score and high school rank and grade point average. Based on this relationship, high school rank and grade point average have been substituted for pretest score in skiing and archery. Table 12 shows that high school rank and grade point average do not have a significant effect on final exam score. The method of instruction has no significant effect; therefore, the analysis fails to reject the null hypothesis that method of instruction does not affect achievement for skiing. Students do equally well, it appears, in the audio-tutorial

Table 12. ANCOVA for skiing achievement

Variable	df	F
Covariate		
High school rank	1	0.99
Grade point average	1	0.00
Main effect		
Method of instruction	1	0.68
Explained	3	0.67
n = 34		

and lecture/lab classes. Although high school rank and grade point average may serve as an appropriate substitute in other areas of research for pretest score, the lack of significance here shows that it does not hold true in skiing.

Similar to the skiing class, high school rank and grade point average have been substituted for pretest score. Table 13 shows that high school rank and grade point average

Table 13. ANCOVA for archery achievement

Variable	df	F
Covariate		
High school rank	1	0.00
Grade point average	1	1.57
Main effect		
Method of instruction	1	1.93
Explained	3	1.69
n = 21		

do not have a significant effect on final exam score. The method of instruction has no significant effect; therefore, the analysis fails to reject the null hypothesis that method of instruction does not affect achievement means for archery. Students, regardless of previous ability or method of instruction, do equally well in audio-tutorial and lecture/lab. Lack of significance for high school rank and grade point average provides evidence that their substitute for pretest score does not hold true for archery.

Data in Table 14 show that pretest score has a highly significant effect on final exam score. The method of

Table 14. ANCOVA for weight training achievement considering students' year in school

Variable	df	F
Covariate		
Pretest score	1	21.50**
Main effect		
Method of instruction	1	0.01
Year in school	1	2.89
2-way interaction of main effects	1	1.90
Explained	4	6.66**
n = 40		

**Significant at .01 level.

instruction and year in school do not have a significant affect; therefore, the analysis fails to reject the null

hypothesis that methods of instruction do not affect achievement of students in different years of school for weight training. Students do as well regardless of how they were taught or what year they were in school. It appears that any differences in achievement were due to the pre-course evaluation score. Unadjusted means for lecture/lab were 37.53 and for the audio-tutorial section were 38.35. Adjusted means for lecture/lab were 37.92 and for the audio-tutorial section were 38.06. The interaction of method of instruction and year in school does not appear to create a significant relationship. Due to small sample size, students were grouped as underclassmen and women (freshman and sophomore) and upperclassmen and women (juniors and seniors). For year in school analysis, there were only four graduate students and weight training was the only class with graduate students; therefore, they were not used.

According to Table 15, pretest score has a highly significant effect on final exam score. The method of instruction and year in school do not have a significant effect; therefore, the analysis fails to reject the null hypothesis that method of instruction does not affect achievement of students in different years of school for football officiating. What football officials knew before the course affects how they do in the end.

The relationship of high school rank and grade point

Table 15. ANCOVA for football officiating achievement considering students' year in school

Variable	df	F
Covariates		
Pretest score	1	7.24**
Main effects		
Method of instruction	1	0.04
Year in school	1	0.06
2-way interaction of main effects	1	0.66
Explained	4	2.00
n = 25		

**Significant at .01 level.

average have been substituted for pretest score based on the Pearson Correlation Matrix. Table 16 shows that high

Table 16. ANCOVA for skiing achievement considering students' year in school

Variable	df	F
Covariates		
High school rank	1	0.97
Grade point average	1	0.00
Main effects		
Method of instruction	1	0.53
Year in school	1	0.33
2-way interaction of main effects	1	0.98
Explained	5	0.65
n = 34		

school rank, grade point average, method of instruction, and year in school do not have a significant effect on

final exam score; therefore, the analysis fails to reject the null hypothesis that method of instruction does not affect achievement of students in different years of school for skiing. Students of all years in school appear to do equally as well in audio-tutorial and lecture/lab.

High school rank and grade point average were substituted for pretest score. Table 17 shows that high school

Table 17. ANCOVA for archery achievement considering students' year in school

Variable	df	F
Covariates		
High school rank	1	0.00
Grade point average	1	1.61
Main effects		
Method of instruction	1	1.59
Year in school	1	0.07
2-way interaction of main effects	1	2.30
Explained	5	1.51
$n = 21$		

rank, grade point average, method of instruction, and year in school do not have a significant effect on final exam score; therefore, the analysis fails to reject the null hypothesis that there would be no difference in achievement means of students in different years of school for archery. Students' ability to achieve appears unaffected by previous

ability, method of instruction, or year in school.

The data in Table 18 show that pretest score has a significant effect on attendance frequency (F = 16.49).

Table 18. ANCOVA weightlifting attendance frequency considering pretest score and method of instruction

Variable	df	F
Pretest score	1	16.49**
Method of instruction	1	23.59**
Explained	2	20.04**
n = 44		

**Significant at .01 level.

The method of instruction does have a significant effect on attendance frequency (F = 23.59); therefore, the null hypothesis that weightroom attendance frequency will not be different is rejected. Student attendance frequency was affected by precourse knowledge and method of instruction. Students who use the audio-tutorial method attend more often and students who know more at the start of the course also know more at the end of the course. Unadjusted means for lecture/lab were 16.45, for audio-tutorial were 19.33. Adjusted means for lecutre/lab were 16.48, for audio-tutorial were 19.30. It would appear that the flexibility and freedom allowed by the audio-tutorial method

contributed to increased attendance.

As shown by Table 19, pretest score has a significant effect on attendance duration (F = 11.55). The method of

Table 19. ANCOVA for weight training attendance duration considering pretest score and method of instruction

Variable	df	F
Pretest score	1	11.55**
Method of instruction	1	20.70**
Explained	2	16.13**
n = 44		

**Significant at .01 level.

instruction does have a significant effect on attendance duration (F = 20.70); therefore, the analysis rejects the null hypothesis that weightroom attendance duration will not be different. Students' attendance duration was affected by precourse knowledge and method of instruction. Audiotutorial students with a higher initial knowledge stayed in the weight room longer. Unadjusted means were 50.70 for lecture/lab, 60.25 for audio-tutorial. Adjusted means were 50.80 for lecture/lab, 60.17 for audio-tutorial. Audio-tutorial students with a higher initial knowledge stayed in the weight room longer. Freedom of choice as to when audio-tutorial students could work out and the reduced

stress of staying in class only as long as they wanted appeared to contribute to the higher attendance duration.

According to Table 20, pretest weight lifted does have a significant effect on posttest weight lifted (F = 104.94).

Table 20. ANCOVA for weight lifting posttest lift

Variable	df	F
Pretest lift	1	104.94**
Method of instruction	1	1.90
Explained	2	53.42**
n = 44		

**Significant at .01 level.

Method of instruction does not have a significant effect on posttest weight lifted; therefore, the analysis fails to reject the null hypothesis that the method of instruction will not cause a difference in amounts of weight lifted by the students at the end of the course. The method of instruction may not affect the amount of weight lifted at the end of the course, but the amount lifted at the start of the course does have an effect on the amount a student lifts at the end of the course.

In Table 21, the pretest score does not have a significant effect on student body weight change. Pretest body weight does not have a significant effect on student body

Table 21. ANCOVA for weight lifting body weight change

Variable	df	F
Covariates		
Pretest score	1	0.02
Pretest body weight	1	0.02
Method of instruction	1	4.26*
Explained	3	1.44
n = 44		

*Significant at .05 level.

weight change either. However, the method of instruction does have a significant effect on student body weight change ($F = 4.26$); therefore, the analysis rejects the null hypothesis that the method of instruction does not cause a significant difference in student body weight change. Students in the audio-tutorial section were able to cause a greater change in their body weight.

Unadjusted means were 1.30 for lecture/lab, 3.04 for audio-tutorial. Adjusted means were 1.23 for lecture/lab, 3.10 for audio-tutorial. When we adjust for precourse knowledge and precourse body weight, the means became further apart. The flexibility of the audio-tutorial class and the reduced stress associated with the flexibility contributes to the audio-tutorial students being able to change their body weight.

Using Table 22, the pretest score does have a

Table 22. ANOVA for football officiating skill evaluation

Variable	df	F
Pretest score	1	6.32*
Method of instruction	1	24.67**
Explained	2	15.49**
n = 25		

*Significant at .05 level.
**Significant at .01 level.

significant effect on football officiating skill evaluation (F = 6.32). The method of instruction also has a highly significant effect on football officiating skill evaluation (F = 24.67); therefore, the analysis rejects the null hypothesis that method of instruction does not affect football officiating skill evaluation. Audio-tutorial students did better than lecture/lab students on football officiating skill evaluation.

Unadjusted means were 30.46 for lecture/lab, 35.00 for audio-tutorial. Adjusted means were 30.48 for lecture/lab, 34.98 for audio-tutorial. The increased flexibility and freedom to view and review the football officiating materials created an ideal learning situation for audio-tutorial students. This atmosphere helped the audio-tutorial student to excel.

Within Table 23, high school rank, grade point average, archery pretest hits, and method of instruction do not have

Table 23. ANCOVA for archery score improvement

Variable	df	F
High school rank	1	0.43
Grade point average	1	1.38
Archery pretest hits	1	3.25
Method of instruction	1	1.93
Explained	4	2.12
n = 21		

a significant effect on archery score improvement; therefore, the analysis fails to reject the null hypothesis that the method of instruction will not create a significant difference in archery score improvement. Regardless of student knowledge or skill prior to the course, or the method of instruction, students in the audio-tutorial and lecture/lab sections did equally well.

Summary of ANCOVAs

It may be concluded that method of instruction had no significant effect on achievement. Precourse knowledge did have a significant effect on achievement, while high school rank and grade point average did not significantly affect achievement. Method of instruction did have a significant affect on weight room attendance frequency, duration and body weight change, and football officiating skill evaluation. This is supported by the t-scores and Pearson Correlation Matrix. It would appear that the

relaxed atmosphere, flexibility and freedom of study time provided by the audio-tutorial system contribute to the effects and differences that have been shown.

Regression analysis is a general statistical technique through which one can realize the relationship between a dependent or criterion variable and a set of independent or predictor variables. Multiple regression may be viewed either as a descriptive tool or as an inferential tool. Through multiple regression techniques, the researcher could obtain a prediction equation that indicates how scores on the independent variables could be weighted and summed to obtain the best possible prediction for the group.

Stepwise regression is used when a researcher wishes to isolate a subset of available predictor variables that will yield an optimal prediction equation with as few terms as possible. The regression equation is for weight training only. The dependent variable was achievement, and the independent variables were attendance frequency, method of instruction, precourse exam, attendance duration, sex, grade point average, high school rank, age, and year in school.

According to Table 24, attendance frequency has a highly significant relationship with students' achievement ($F = 138$). Method of instruction has a highly significant relationship with student achievement ($F = 155$). Pretest

Table 24. Regression of selected variables on achievement

Variable	Beta	B	t
Attendance frequency	1.024	3.602	14.16**
Method of instruction	-.340	-6.811	-5.73**
Pretest score	.122	.124	-2.03*

n = 44
r^2 = .89
Constant (a) = 12.93

*Significant at .05 level.
**Significant at .01 level.

score has a highly significant relationship with student posttest scores (F = 112). Attendance frequency and achievement had a highly significant relationship with post-test score on the Pearson Correlation Matrix. However, method of instruction was a new relationship that was not indicated on the Pearson Correlation Matrix. Variables that were on the Pearson Correlation Matrix which did not show up in the regression were: high school rank, grade point average, and attendance duration (see Table 4).

The analysis fails to reject the null hypothesis that no significant relationships exist. The equation would be as follows:

$$\hat{Y} = a + b_1X_1 + b_2X_2 + b_3X_3$$

where:

X_1 = attendance frequency;

X_2 = method of instruction; and

X_3 = pretest achievement.

Achievement = 12.93 + 3.60 (attendance frequency)
- 6.81 (method of instruction)
+ 0.12 (pretest score)

Dummy variables are most commonly used when a researcher wishes to insert a nominal-scale variable into a regression equation. Since the numbers assigned to categories of a nominal scale are not assumed to have an order and unit of measurement, they cannot be treated as scores as they would be in conventional regression analysis. A set of dummy variables is created by treating each category of a nominal variable as a separate variable and assigning arbitrary scores for all cases depending on their presence or absence in each of the categories. In the case of weight training and football officiating, pretest scores exist. In the case of skiing and archery, pretest scores do not exist. Stepwise regression utilizing dummy variables could be used to test the null hypothesis that there would be no significant relationship among posttest score and sport area, method of teaching, achievement pretest and selected demographic variables. However, in an attempt to prepare a regression equation for all sport

areas, it was determined that due to confounding information (it was not possible to separate out whether there was a pretest or not a pretest or which group a student was in), only one equation could be developed. Because of these limitations, regression equations were not completed in the other sports areas or all sports areas combined.

Review of Student Questionnaire

The purpose of the review was to collect data that would reflect student feelings and attitudes about the course and materials used to teach the course.

Questions 1 through 10 (shown in Table 25) show data collected in weight training audio-tutorial section. The rest of the data presented were collected from lecture/lab and audio-tutorial classes.

These data were collected to be used for changing and improving existing learning packages. Comments in general were very positive. Most students (92%) found the material available and in good working order (88%). They indicated that the materials had clear instructions (79%) and visuals that were appealing (96%). Although students sometimes (12%) or always (17%) requested help from the instructor, the majority (71%) progressed through the course on their own. Most students (63%) progressed through the course by repeating some or all sections of the lessons. Only a few

Table 25. Student attitudes towards autio-tutorial classes

Question	Response (%)		
	Yes, always	Some-times	No, never
1. Were A-T packages available?	22 (92)	2 (8)	0
2. Did equipment work?	21 (88)	3 (12)	0
3. Were instructions clear?	19 (79)	5 (21)	0
4. Were visuals good?	23 (96)	1 (4)	0
5. Did you replay tape?	6 (25)	15 (63)	3 (12)
6. Did you need instructor help?	4 (17)	3 (12)	17 (71)
7. Did you do all exercises?	23 (96)	0	1 (4)
8. Did you use a partner?	24 (100)	0	0
9. Did you use seminar?	7 (29)	17 (71)	0
10. Would you take A-T again?	23 (96)	0	1 (4)

(11%) were not able to complete all exercises. It was reassuring to know that all (100%) students exercised value judgment by using a partner as was stressed for safety. Only one student did not care to use the audio-tutorial system again.

There appeared to be the largest percentage of students in both classes taking the course as an elective (see Table 26). The balance between the audio-tutorial section (60 students - 48.4%) and the lecture/lab (64 students - 51.6%) was good, although a larger sample would have been better.

Table 26. Reason for taking audio-tutorial, lecture/lab class

Section	Required course	Elective course
Audio-tutorial	14 (23%)	46 (77%)
Lecture/lab	10 (16%)	54 (84%)

n = 124

Table 27 shows that there were more students in the lecture/lab section in the freshman, sophomore, junior and graduate years, but fewer in the senior year.

Table 27. Student year in school

Section	Fresh-man	Sopho-more	Junior	Senior	Graduate student
Audio-tutorial	15	9	9	26	1
Lecture/lab	17	15	16	13	3

n = 124

Out of 124 student subjects, 33 were female (see Table 28). All audio-tutorial sections had male and female subjects. The only lecture/lab class without female subjects was football officiating.

Six categories reflecting student attitudes towards the course were outlined in Table 29. Student responses were scored on a table from one through five with 1 being

Table 28. Student sex by class

Course	Male		Female	
	Lecture/ lab	Audio- tutorial	Lecture/ lab	Audio- tutorial
Weight training	16	15	4	9
Football officiating	13	11	0	1
Skiing	12	10	8	4
Archery	7	7	4	3
Totals	48	43	16	17

n = 124

a very low rating to 5 being the highest possible rating. All scores were tabulated by the Iowa State University testing service. Department of Physical Education scores for other courses during the same time period were included for comparison purposes.

Table 29. Student attitude responses

Category	Audio-tutorial mean	Lecture/lab mean	Department mean
Organization/efficiency	4.56 (1)[a]	4.24 (3)	4.40 (2)
Attitude	4.34 (3)	4.47 (2)	4.60 (1)
Student interest	4.52 (2)	4.56 (1)	4.33 (3)
Interaction	4.54 (1)	4.53 (2)	4.52 (3)
Explanation	4.05 (3)	4.56 (1)	4.39 (2)
Evaluation	4.38 (3)	4.41 (2)	4.49 (1)

n = 124

[a]Rank in parentheses.

The audio-tutorial section ranked highest in the area of organization and efficiency and interaction. This would

seem to make sense, since the audio-tutorial course requires organization to be self-sufficient. Attitude, explanation and evaluation ranked lowest, probably because the student was forced to be so independent and self-motivated.

Selected audio-tutorial student responses

The following are a selection of student responses on an open area for student comments:

> "The course was well-organized and used available time efficiently."
>
> "The instruction was interesting and helped self-generate enthusiasm about the class."
>
> "The instruction stimulates student interest."
>
> "The instructor was respectful, tolerant and fair with students during help sessions."
>
> "The course materials were explained carefully and thoroughly."
>
> "The instruction provided clear and appropriate procedures for demonstrating competency in the course."

The questionnaire gave valuable feedback that is necessary for any course that has an expanding and continually changing format and content.

CHAPTER V. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Chapter V will present the summary, conclusions, and recommendations of this study of audio-tutorial (A-T) system's approach to recreational learning at Iowa State University.

Summary

The goal of this investigation was to evaluate the relative effectiveness of the two methods, audio-tutorial and lecture/lab, for instruction of Iowa State University students in weight training, football officiating, skiing, and archery.

Eleven null hypotheses were generated and tested. The first four hypotheses dealt with cognitive achievement. The next six hypotheses dealt with individual factors within each class. Hypothesis eleven dealt with the capability to predict. A descriptive review section dealt with student attitude differences.

The study was limited to two types of instruction. The experimental group was the audio-tutorial (A-T) students, while the control group was the lecture/laboratory (L/L) students. Only existing classes were used and the study was limited to students at Iowa State University.

The independent variables of the study were method of instruction, pretest, sex, high school rank, grade point average, age, year in school, attendance frequency, attendance duration, lift improvement, body weight change, archery score improvement, and football skill evaluation. The dependent variable of the study was the final examination (posttest score).

The review of literature described some of the methods and theories currently being used in teaching. Individualized instruction methods reviewed were computer-assisted instruction, guided design, personalized system of instruction, and the audio-tutorial system. An extensive review was made of the Postlethwait system from its beginning in 1962 to its present-day usage. It was found that the A-T system exists in most disciplines with a higher number of research articles produced in the science and biology areas, in particular.

The findings of Fisher and MacWhinney seemed to summarize the most common research findings. Of 44 studies, 30 comparing methods favored the A-T method, 1 favored the lecture method, and 13 found no significant difference between the two methods.

The methods and procedures, Chapter III, included an outline of the population, development and administration of the pretest and posttest, and the process of securing

data from student records. Four methods of data analysis were used. The Pearson Correlation Matrix indicates that there were significant relationships between variables in all four classes. The t-test analysis indicated that there were significant differences in the means of three variables in weight training. They included attendance frequency, attendance duration and body weight change. Since there were relationships and differences in means, analysis of covariance was utilized to test all hypotheses. A regression analysis was completed and an equation was developed for predicting future student scores.

Conclusions

As a result of the findings, all four hypotheses stating that no significant difference in the post course cognitive achievement would be found with respect to method of instruction were retained. This result included adjustment for variable difference in pretest scores, high school rank, grade point average, and year in school.

The hypothesis stating that no significant difference between methods of instruction and weight room attendance frequency would be found, adjusting for pretest score, was rejected. Students' attendance frequency was related to precourse knowledge and method of instruction.

The hypothesis stating that no significant difference

between methods of instruction and weight room attendance duration would be found, adjusting for pretest score was rejected. Students' attendance duration was affected by precourse knowledge and method of instruction.

The hypothesis stating that no significant difference between methods of instruction and posttest lift would be found, adjusting for pretest lift, was retained.

The hypothesis stating that no significant difference between methods of instruction and body weight change would be found, adjusting for pretest score, was rejected. A-T students' body weight change was greater than that of L/L students.

The hypothesis stating that no significant difference between methods of instruction and football officiating skill evaluation would be found, adjusting for pretest score, was rejected. A-T students scored higher on football officiating skill evaluation than L/L students.

The hypothesis stating that no significant difference between methods of instruction and archery score improvement, adjusting for high school rank and grade point average, was retained.

The hypothesis stating that no significant relationship among final exam score and method of teaching, achievement pretest and selected demographic variables was rejected. A prediction equation was written including three variables:

attendance frequency, method of instruction and precourse knowledge.

Recommendations

Recommendations were made with respect to the findings and conclusions reached in the study. The following recommendations were made for classes in physical education and recreation:

(1) Research studies in the audio-tutorial method of instruction should be replicated. Since it was not possible to determine differences in subject matter areas or differences of pretest, due to the fact that not all students had a pretest, a precourse test should be administered to all subjects. The Solomon 4-group design could be used which would enable the researcher to make several other statistical analyses. First, the pretest and posttest means of a group can be compared to determine the actual change brought about by the experimental treatment. Second, the posttest scores of two pretested groups can be used to compare the experimental treatment with the control group treatment. Third, the same analysis can be done on the two unpretested groups, one of which received the experimental treatment and the other of which served as a control. A final way to determine the effect of the experimental treatment is to compare the pretest scores of group one and group two with the

posttest score of group three. The Solomon 4-group design requires a rather large sample and much researcher effort.

(2) The same measuring devices may be used for future research. The reliability and validity of each test can be further improved by reviewing the testing service test item analysis. Certain test items may be replaced which would contribute to greater test reliability and validity.

(3) The experimental treatment will change as new technology in the media center is used. The ease of use and streamlining of individualized instruction will affect the comparison of differences in treatment.

(4) The same hypothesis and the same variables may be kept in the replication of this study. However, there may be additional hypotheses and variables included which coincide with each of the following recommendations.

(5) Research should be done that would collect and evaluate data on characteristics of students and teachers who experience success with specific methods of instruction. Instruments that assess individual capacities could be used. Research on teaching and learning styles should provide new information and worthwhile data that may show that certain styles fit certain subject areas better than others.

(6) At Iowa State University, existing facilities and equipment were shared, making the cost of course offerings less expensive than the traditional method. Keeping in mind that student achievement was at least as good, the lower cost factor, using the audio-tutorial method, should have an impact on administrators during periods of tight economics. Further research on administrative attitudes may have implications for its future use.

(7) Self-paced learning and flexibility for the student have had an effect on student anxiety and stress in other areas of education. Further research utilizing standardized psychological tests as well as physiological tests (blood tests, muscle fiber tests) would probably yield worthwhile results if this area of research were pursued.

(8) Further research in similar studies should be done on retention in order to compare the retention of subject content taught by different methods of instruction.

(9) Time organization and usage is a factor in today's society. Research on compressed speech and associated media equipment that complements efficient time usage should be initiated to provide further data for improved research in future studies.

Numerous factors point toward an increasing need for innovations in teaching-learning experiences and for greater flexibility in the educational environment. Among these factors are a greater variety between student and teacher characteristics, such as type and degree of motivation, prerequisite backgrounds and educational experiences, age, and maturity. Financial stringency places an additional burden on attempts to respond to contemporary educational needs. All these factors point toward a need for greater flexibility of the educational environment.

The audio-tutorial methods of teaching cognitive content in Physical Education and Recreation courses is neither superior nor inferior to the traditional lecture/lab methods. The results of this study are consistent with the results of many other studies. Since the major emphasis in many Physical Education and Recreation courses is in the development of psycho-motor skills and the minor emphasis is on cognitive content, the use of audio-tutorial techniques provides greater flexibility and efficiency for more effective and efficient use of instructor and student time.

There is, therefore, ample justification for continuing assessment and evaluation of both old and new methods of teaching and learning. Because of its ability to cope with the funds of accumulating knowledge in numerous fields, and its capacity to respond to technological developments, the

audio-tutorial system is worthy of continuing research and development as a means of bringing harmony to educational ends and means in a rapidly changing environment.

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APPENDIX A. AUDIO-TUTORIAL CONGRESS

SYRACUSE UNIVERSITY

COLLEGE FOR HUMAN DEVELOPMENT | 300 SLOCUM HALL | SYRACUSE, NEW YORK 13210

TELEPHONE 315 | 476-5541 | EXTENSION 2397

October 3, 1972

Mr. Alan Murdoch
Physical Education for Men
214 Beyer Hall
Iowa State University
Ames, Iowa 50010

Dear Mr. Murdoch:

Thank you for submitting a paper on: "Audio-Tutorial Systems Approach to Recreational Learning." It has been accepted for presentation at the Fourth Annual Audio-Tutorial Congress Conference at Columbia, S. C.

The paper session will be held from 10:30 - 12:30 A.M., Saturday, November 4, 1972 in the Carolina Coliseum, rooms to be announced. You will have 5 minutes to speak and 5 minutes for questions. A copy of your abstract will be given to all those attending the Congress.

I would appreciate a letter from you indicating your willingness to speak on November 4th. We are sorry that our budget will not allow travel allowances or honorarium but we are looking forward to hearing about your experiences with A-T.

Sincerely,

Sarah H. Short

Sarah H. Short, Ph.D.
Secretary, A-T Congress

SHS/atm

October 11, 1972

Sarah H. Short, Ph. D.
Secretary, A.T. Congress
College for Human Development
300 Slocum Hall
Syracuse, New York 13210

Dear Dr. Short:

Thank you very much for the opportunity to participate at the Fourth Annual Audio-Tutorial Congress Conference. I shall be prepared to make my presentation at the time and place listed.

I expect to arrive Thursday, November 2, at around 5:00 P.M. Once again, thank you and we shall see you at the conference.

Sincerely,

Alan Murdoch

AM/jvk

APPENDIX B. INNOVATIVE TEACHING GRANT

Interoffice Communication | IOWA STATE UNIVERSITY of Science and Technology

DATE February 26, 1973

TO Alan Murdoch

FROM George C. Christensen
Vice President for Academic Affairs

I am pleased to inform you that the Council on Instruction has approved your application for an Innovative Teaching Grant. However, because of limited resources your application is being funded for only $500.

Please use account number 400-13-07, project 17, when making purchases and forward copies of all purchase requisitions and invoices to this office.

We shall look for a progress report by December 31, 1973, and a final report by June 30, 1974.

Congratulations and best wishes in your efforts on this project.

George C. Christensen

GCC:ah

APPENDIX C. COURSE OUTLINE AND OBJECTIVES

Weight Training I

LESSON ONE:

1. Introduce self.
2. Office hours.
3. Phone.
4. This is section ____.
5. Class meets from ____ to ____ on _____ (days).
6. Required dress.
7. Locker rental procedure and cost.
8. TEXTBOOK: "WEIGHT TRAINING: A SYSTEMATIC APPROACH."
9. It is important to attend class! Only by training at least three times a week can you gain maximum strength and conditioning.
10. Grading (100 possible points)

    A 85-100
    B 65-84
    C 35-64
    D 15-34
    F 0-14

Pre-test performance	16%
Post-test performance	40%
Improvement	24%
Written examination	20%

    Tests are set up so that you must do well on both pre- and post-test to earn an "A" for the course (i.e., if you earn an "A" on pre-test, you are not expected to improve as much as a person getting a "C" on pre-test).

11. The "average" gain per exercise during the semester is 43 pounds.
12. Assignment: Read chapters 1 and 2. Study and understand the "Systematic Approach" in chapter 2.

13. NEXT CLASS: Meet in weight room. You may wear street clothes.

LESSON TWO:

1. Take roll.
2. Explanation of the weight training system used in class. Individualized according to each person's strength on each exercise.
3. Explain the pre-test. Each student finds what he can lift in each exercise for ONE repetition using proper technique.
4. Weigh each student.
5. NEXT CLASS: Dressed out and meet in weight room for pre-test.

LESSON THREE:

1. Talk briefly about safety.
2. Breathing: Breathe out as you apply force (or after). Breathe in during resting stage. Breathe on each rep to keep $\overline{O_2}$ in muscles.
3. Lifting:
   A. Always go through "full range of motion."
   B. Lock out (bench, etc.)
   C. Avoid jerky motions.
   D. Let weights down slowly - NEVER DROP.
4. Demonstrate or have a student demonstrate exercises:
   A. Bench Press - Both feet flat on floor, avoid lifting buttocks, extend arms fully (lock out).
   B. Leg Press - Use only legs. Partner change key. Use heavy side and upper foot plates. Lock out.
   C. Curls - Supinated grip. All parts of body erect and motionless throughout. Lift from thighs to chest.
   D. Leg Extensors - Sitting position, back straight, stabilize body by grasping edge of table. Lift

until knees straight.

E. Standing or Seated Press (short people stand) - Pronated hand grip. Push overhead from chest level until arms are fully extended.

F. Sit ups - Start with rung #2 - knee up - raise torso until both elbows touch knees. Buttocks tight against heels. Hook feet. Flext next to initiate move.

G. Pull downs (Lats) - Seated - legs crossed. Back and neck erect. Pull down to behind neck and shoulders. If can't stay seated, put weight on thighs. Extend arms fully on recovery.

H. Leg Curls - Lay flat on stomach. Hook knees. Pull to Buttocks. Turn head to side and grip pad.

I. Upright Rowing - Pronated grip. Bar on thighs, arms and legs straight. Bar raised to chin and returned completely. Hands 6-8" apart. Elbows high as possible. Erect back, legs, etc.

J. Squats - 2 x 50, no weight. Hang onto side of something for balance. RUSSIANS USE THESE! Back straight, neck straight. Start with 2 sets of 25 for 2 weeks.

K. Pull ups - Body erect. No twisting, pulling, etc. (Record number you can do.) Each day do 20 in as few sets as possible.

5. Group students in twos. Same weight and height. Begin finding maximum poundage for one repetition. Report poundages to the instructor. Try to find 3 or 4 maximums today. THE VARIABLE RESISTANCE STATIONS ON NEW MACHINE MAY NOT BE USED IN TESTING!!!

LESSON FOUR:

1. Finish finding maximums (pre-test).

LESSON FIVE:

1. Workout number ONE. During class periods, motivate, make corrections in technique, etc.

Remainder of lessons: Student works out in class. Strongly recommend and motivate students to exercise outside of class time, too.

WEIGHT TRAINING I

PRE-TEST

Points	Grade	121-135	136-150	151-165	166-180	181-195	196-210	211-225	226-240
16	A[2]	1150+	1200+	1250+	1300+	1350+	1400+	1450+	1500+
16	A	1050-1147	1100-1199	1150-1249	1200-1299	1250-1349	1300-1399	1350-1449	1400-1499
14	A	1000-1049	1050-1099	1100-1149	1150-1199	1200-1249	1250-1299	1300-1349	1350-1399
12	B	950-999	1000-1049	1050-1099	1100-1149	1150-1199	1200-1249	1250-1299	1300-1349
10	B	900-949	950-999	1000-1049	1050-1099	1100-1149	1150-1199	1200-1249	1250-1299
9	C	850-899	900-949	950-999	1000-1049	1050-1099	1100-1149	1150-1199	1200-1249
8	C	800-849	850-899	900-949	950-999	1000-1049	1050-1099	1100-1149	1150-1199
6	C	700-799	750-849	800-899	850-949	900-999	950-1049	1000-1099	1050-1149
4	D	0-699	0-749	0-799	0-849	0-899	0-949	0-999	0-1049

Women should be put in same weight categories, but their total poundage should be multiplied by 150%. Body weights below 121 pounds can be set up in 50-pound intervals following the same pattern as shown above.

WEIGHT TRAINING I

POST-TEST

Points	Grade	121-135	136-150	151-165	166-180	181-195	196-210	211-225	226-340
40	A	1275+	1325+	1375+	1425+	1475+	1525+	1575+	1625+
37	A	1250-1274	1300-1324	1350-1374	1400-1424	1450-1475	1500-1524	1550-1574	1600-1624
35	A	1200-1249	1250-1299	1300-1349	1350-1399	1400-1449	1450-1499	1500-1549	1550-1599
32	B	1175-1199	1225-1249	1275-1299	1325-1349	1375-1399	1425-1449	1475-1499	1525-1549
30	B	1150-1174	1200-1224	1250-1274	1300-1324	1350-1374	1400-1424	1450-1474	1500-1524
27	B	1125-1149	1175-1199	1225-1249	1275-1299	1325-1349	1375-1399	1425-1449	1475-1499
25	C	1100-1124	1150-1174	1200-1224	1250-1274	1300-1324	1350-1374	1400-1424	1450-1474
22	C	1050-1099	1100-1149	1150-1199	1200-1249	1250-1299	1300-1349	1350-1399	1400-1449
18	C	1000-1049	1050-1099	1100-1149	1150-1199	1200-1249	1250-1299	1300-1349	1350-1399
15	C	900-999	950-1049	1000-1099	1050-1149	1100-1199	1150-1249	1200-1299	1250-1349
12	D	0-899	0-949	0-999	0-1049	0-1099	0-1149	0-1199	0-1249

Women should be put in the same weight categories, but their total poundage should be multiplied by 150%. Body weights below 121 pounds can be set up in 50-pound intervals following the same pattern as shown above.

WEIGHT TRAINING I

Improvement Grade

GRADE ON PRE-TEST					
		A^2	A	B	C or D
POINTS	GRADE				
24	A	200+	300+	350+	400+
22	A	150-199	250-299	300-349	350-399
20	A	100-149	200-249	250-299	300-349
18	B	50- 99	150-199	200-249	250-299
16	B	0- 49	125-149	150-199	200-249
14	C		100-124	125-149	175-199
12	C		75- 99	100-124	150-174
10	C		50- 74	75- 99	125-149
8	C		0- 49	50- 74	75-124
6	D			0- 49	50- 74
4	D				0- 49

Grading Scale for
WEIGHT TRAINING I--PE

Score	Points	Grade
46-50	20	
44-45	19	A
42-43	18	
39-41	17	
37-38	16	
35-36	15	B
33-34	14	
31-32	13	
29-30	12	
27-28	11	
25-26	10	C
23-24	9	
21-22	8	
19-20	7	
17-18	6	
15-16	5	D
13-14	4	
11-12	3	
0-10	2	F

WEIGHT TRAINING

GRADE BREAKDOWN

A - 85
B - 65
C - 35
D - 15

NAME	Pretest-16% Scr	Grd	Pts	Posttest-40% Scr	Grd	Pts	Imprvmnt-24% Scr	Grd	Pts	Wr. Exam-20% Scr	Grd	Pts	Total Points	Final Grade

19__
Section____
Semester_____

WEIGHT TRAINING I

Pre-Post Test Recording Sheet

NAME	BODY WEIGHT		BENCH	LEG P	CURLS	Leg E	M. PRESS	LEG C	ROWS	TOTALS
		Pre:								
		Post:								

Football Officiating
P.E. 217, Section 1
Course Outline

A. Instructor

Alan Murdoch — Office -- 294-4980
111 State Gym — Home -- 233-2816
Office Hours: 12:00-1:00 p.m., Tuesday, Thursday
1:00-3:00 p.m., Monday, Wednesday, Friday

B. Objectives of Course:

1. To develop an appreciation of the values of football officiating as a recreational activity now and in later life.
2. To develop an interest in football officiating.
3. To develop a knowledge and understanding of the skills, terminology, scoring and rules so the individual may enjoy football officiating as a participant or a spectator.
4. To develop proper attitudes for safety and utilize favorable aspects to develop athletic sportsmanship.

C. Skills to be Covered:

1. Selection, care and handling of equipment and field space.
2. Nomenclature of the game.
3. Off field preparation.
4. On field responsibilities.
5. Special situations.
6. Analysis of officiating technique.
7. Professional development.
8. Associated activities.

D. Safety Factors to be Covered in the Course:

1. Use of proper protective equipment.
2. Importance of proper field preparation.
3. Preventative counseling.
4. Sports philosophy development.

E. Suggested Sequence of Course:

August 30 - Course Introduction and Enrollment.
September 1 - Field, Players, Equipment & Signals; Rule 1.
6 - Terminology, N.F.S.H.S.A.; Rules 2 & 3.

September 8 - Visual Definitions; Rules 4 & 5; 3-Man Team, 4-Man Team.
13 - Kicking Game; Rule 6.
15 - Passing Game; Rule 7.
20 - Conduct and Penalties; Rules 9 & 10.
27 - FINAL WRITTEN EXAM

F. Evaluation:

1. Pretest (Due September 6 - Noon) . . . . .10 points
2. Scouting Report (H.S. or College). . . . .25 points
3. On Field Evaluation (4 Games). . . . . .25 points
4. Quizzes. . . . . .20 points
5. FINAL EXAM . . . . . .20 points

G. Reference Material:

1. Football Rule Book.
2. Football Case Book.

Downhill Skiing I ½ Semester Credit

P.E. 148

I. Objectives

A. To introduce the student to the sport of downhill skiing
B. To develop a level of skill in skiing which will enable the beginning student to take part in this sport on his/her own
C. To develop a knowledge of safety techniques
D. To instruct the student in the selection and care of ski equipment

II. Course Content

A. Classroom information and activities
   1. Equipment
   2. Clothing
   3. Conditioning for the slopes
   4. Basic ski positions
   5. Tow explanations
   6. Fitting and carrying equipment
   7. Loop film and movies
   8. Safety and etiquette

B. Basic Skills
   1. Walk on skis
   2. Circle
   3. Side step
   4. Herringbone
   5. Straight run
   6. Snowplow
   7. Stop
   8. Fall and get up
   9. Rope tow
   10. Snowplow turns R and L
   11. Traverse
   12. Sideslip
   13. Basic Christy
   14. Uphill Christy
   15. Step Christy
   16. Parallel Christy with pole plant
   17. Kick turn
   18. Tricks--optional

III. Evaluation

A. Written quizzes and final exam
B. Skills test

IV. Reference

Archery I ½ Semester Credit

P.E. 119

I. General Objectives

The general objectives for this course are compatible with the general objectives of the service program.

II. Specific Objectives

A. To promote an appreciation for the values of archery as a life-time recreational activity.
B. To promote an opportunity to develop individual proficiency in the basic fundamentals of free-style archery.
C. To provide an opportunity to acquite knowledge, understanding and insights specific to target shooting.

III. Textbook

Niemeyer, Roy and Zabik, Roger. Beginning Archery. Wadsworth Publishing Co., Belmont, 1978.

IV. Content

A. Nomenclature of the bow and arrow
B. Selection, care and handling of equipment
C. Safety rules and procedures
D. Bracing the bow
E. Techniques of free-style shooting
    1. Addressing the target
        a. Body position
        b. Bow arm position
    2. Nocking
    3. Pre-draw
    4. Draw
    5. Anchor
    6. Aiming
    7. Release
    8. Follow-through
F. Analysis and correction of shooting problems
G. Scoring
H. Shooting at various distances
I. Junior Columbia-Round competition

V. Recommended Sequence

A. Introduction
    1. General class requirements
    2. Textbook, immediate and future use

3. Course objectives
4. Values of archery
    a. Recreation and leisure time
    b. Self-attainment
    c. Health factors
    d. Competitiveness
5. Terminology
6. "Anatomy" of the bow and arrow
7. Equipment procedures
8. Safety rules and procedures

B. Selection and care of tackle
1. Selecting
    a. Bow
    b. Arrows
2. Assignment of equipment
3. Bracing a bow
4. Setting up range and range procedure
    a. Targets (cart, butt and face)
    b. Shooting line and distances
5. Maintaining efficiency of bow and arrows

C. Techniques (present, demonstrate, practice)
1. Stance and body position
2. Holding the bow (suspended grip)
3. Bow arm position
4. String hand position and nocking
    a. Without arrow
    b. With arrow
5. Pre-draw and draw
    a. Without arrow
    b. With arrow
6. Shoot at 10 yards

D. Review
1. Safety rules and procedures
2. Technique

E. Techniques
1. Review and practice previous techniques
2. Present, demonstrate and practice
    a. Anchor (medium)
        1) Without arrow
        2) With arrow
    b. Release
        1) Distance of 15 yards
        2) Nock, draw, hold and release
    c. Follow-through

F. Techniques
   1. Review and practice
   2. Shoot at 20 yards
      a. Emphasize release and follow through
      b. Importance of relaxing and concentration

G. Aiming
   1. Sight
   2. Present, demonstrate and practice
   3. Shoot
      a. 20 yards and 25 yards
      b. Full end (6 arrows) per archer
      c. Emphasize release and follow-through

H. Scoring
   1. Values
   2. Use of score card
   3. Procedure for arrow removal recording
   4. Shoot
      a. 20 yards and 25 yards
      b. Use sight
      c. Record score for each end

I. Free-style shoot and record score
   1. Three ends--20 yards
   2. Three ends--25 yards

J. Shoot free-style and record two ends at each distance--20 yards, 25 yards, 30 yards

K. Shoot free-style and record two ends at each distance--25 yards, 30 yards, 35 yards

L. Shoot free-style and record six ends. Distance is determined by the progress of the class and/or individuals in the class

M. Final practical exam

N. Final written exam

VI. Evaluation

A. Technique (preciseness of form)

B. Scoring (accuracy of shooting)

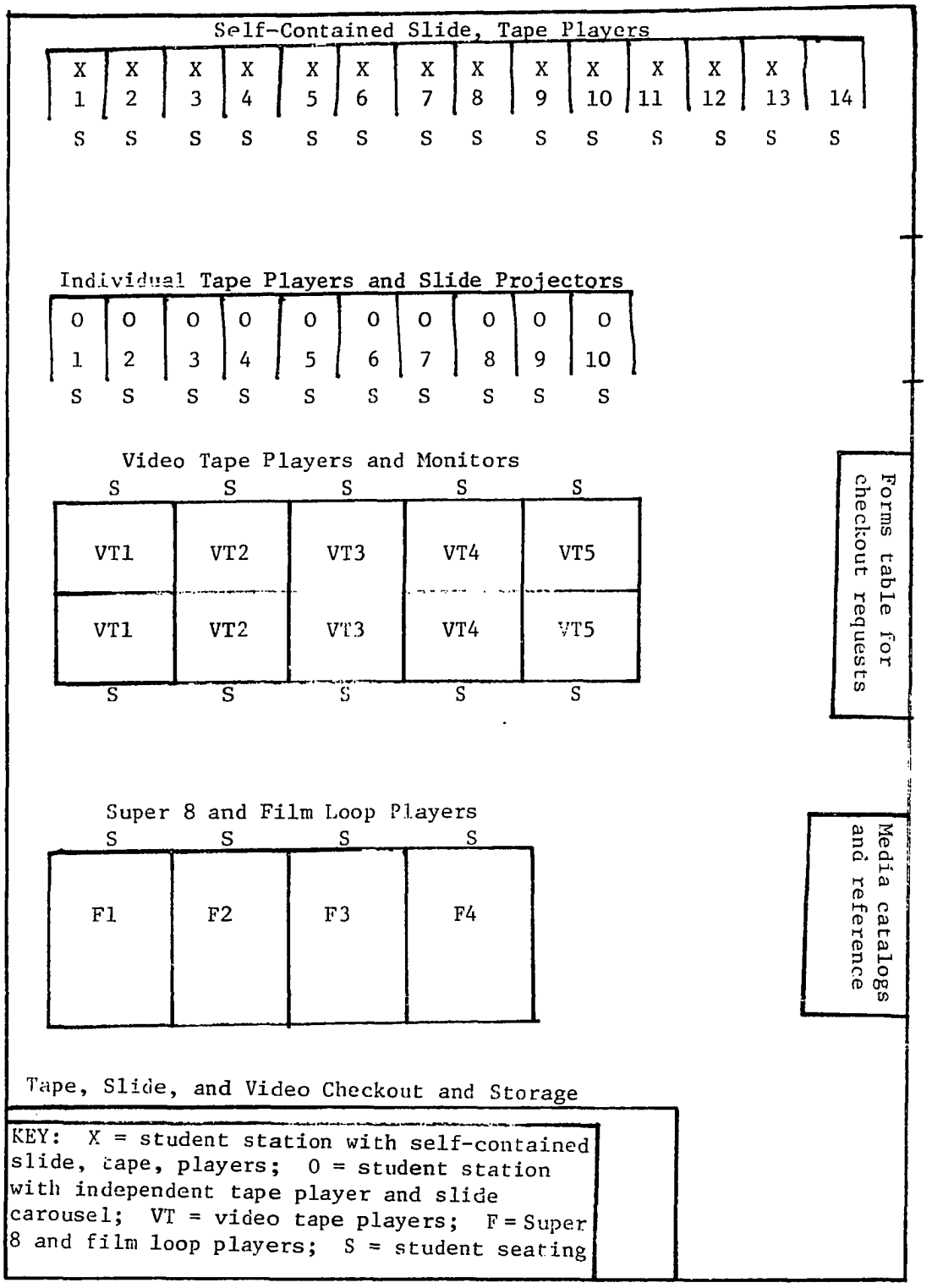
C. Knowledge (comprehension and understanding)

APPENDIX D. AUDIO-TUTORIAL SCRIPT FORMAT

SECTION 1 GROUP Audio-Tutorial PAGE 1

SLIDE		SOUND	NARRATION-STORY
Stationary Skier	Color Introductory slide	Background music	Hello, my name is Alan Murdoch ....
Action slide	Two children skiing	Voice with beep advance to next slide	Skiing is for everyone, young and old ....
A guide for conditioning male & female exercising	Silhouette drawing	Upbeat "Rocky" background music	Skiers must be in top condition ....
A listing of exercises to be completed	Group 1 exercises		Systematic approach to exercising for ski preparation ....
Individual working at exercise	Silhouette drawing	Voice only	Skiing is fun and getting ready can be fun at work ....
Diagram of muscles to be worked	Group I list of objectives		Muscle tone and coordination should be developed before the ski season begins ....

APPENDIX E. LIBRARY MICROFORM AND MEDIA CENTER


Self-Contained Slide, Tape Players
X 1 S
X 2 S
X 3 S
X 4 S
X 5 S
X 6 S
X 7 S
X 8 S
X 9 S
X 10 S
X 11 S
X 12 S
X 13 S
14 S
Individual Tape Players and Slide Projectors
0 1 S
0 2 S
0 3 S
0 4 S
0 5 S
0 6 S
0 7 S
0 8 S
0 9 S
0 10 S
Video Tape Players and Monitors
S S S S S
VT1 VT2 VT3 VT4 VT5
VT1 VT2 VT3 VT4 VT5
S S S S S
Forms table for checkout requests
Super 8 and Film Loop Players
S S S S
F1 F2 F3 F4
Media catalogs and reference
Tape, Slide, and Video Checkout and Storage
KEY: X = student station with self-contained slide, tape, players; 0 = student station with independent tape player and slide carousel; VT = video tape players; F = Super 8 and film loop players; S = student seating

APPENDIX F. INDIVIDUAL ATTENDANCE RECORD AND TESTING FOR ONE REPETITION MAXIMUMS

(Pre Test)

Name _____ Date _____

Exercises	One Rep Maximum
Bench Press	_____
Leg Press	_____
Curls	_____
Leg Extensors	_____
Military Press	_____
Leg Curls	_____
Upright Rows	_____
Total Poundage	_____

Body Weight_____ Grade _____ Points _____

Workout	Date	Percentage of Max
1.	_____	40-45-50-55-60
2.	_____	45-50-55-60-65
3.	_____	50-55-60-65-70
4.	_____	55-60-65-70-75
5.	_____	60-65-70-75-80
6.	_____	55-60-65-70-75
7.	_____	60-65-70-75-80
8.	_____	65-70-75-80-85
9.	_____	60-65-70-75-80
10.	_____	65-70-75-80-85
11.	_____	70-75-80-85-90
12.	_____	65-70-75-80-85
13.	_____	70-75-80-85-90
14.	_____	75-80-85-90-95
15.	_____	70-75-80-85-90
16.	_____	75-80-85-90-95
17.	_____	80-85-90-95-100
18. Test for Max	_____	One Rep Maximum
Bench Press		_____
Leg Press		_____
Curls		_____
Leg Extensors		_____
Military Press		_____
Leg Curls		_____
Upright Rows		_____
Total Poundage		_____

Body Weight_____ Grade _____ Points _____

APPENDIX G. INFORMED CONSENT FORM

Iowa State University
Weight Training, P.E. 166, Sections I & II
Department of Physical Education

Informed Consent Form for Written Pretest, Written Posttest, Aptitude, Grade Point Average and Publication of Test Results.

A standardized written pretest and posttest will be administered in class. These tests have been taken by in excess of 6000 previous students and shall be used to determine knowledge level of written material prior to the course, after the course and improvement.

Each student's aptitude score shall be used as a means of comparing degrees of improvement in the course among students with like grade point averages.

Audio-tutorial materials shall be available to group 2. Group 1 shall be receiving class material in the traditional manner. Both groups shall be physically tested in the traditional manner with no changes.

Results obtained from the testing may, in the future, be used in written or oral research reports but strict standards of subject confidentiality will be adhered to.

I have read this form. I understand the test procedures and I consent to participate in this test and to allow all of my test results to be used for research purposes.

_____ _____

Signature Witness

_____

Date

APPENDIX H. STUDENT QUESTIONNAIRE

WEIGHT TRAINING

This course has been developed through the experiences and testing of over 6000 students. Constant re-evaluation and improvements are only possible with feedback from students. Please answer all questions and fill in additional comments to help us with this process.

A. Learning Packages Evaluation

1. Were the A-T packets available at Library Reserve?

   A. Always B. Sometimes C. Never

   Comments: _____

2. Did the tape player and earphones perform adequately?

   A. Always B. Sometimes C. Never

   Comments: _____

3. Were the A-T packets usage instructions clear?

   A. Always B. Sometimes C. Never

   Comments: _____

4. Were the charts, diagrams, and pictures appropriate?

   A. Always B. Sometimes C. Never

   Comments: _____

5. Did you replay tape more than once?

   A. Always B. Sometimes C. Never

   Comments: _____

6. Was it necessary to ask the instructor for clarification?

   A. Always B. Sometimes C. Never
   Comments: _____

7. Were you able to complete the systematic weight training program (11 exercises)?

   A. Yes B. No

   Comments: _____

8. Were you able to coordinate your learning schedule with a partner?

   A. Yes B. No

   Comments: _____

9. Did you utilize the bi-weekly resource seminar?

   A. Always B. Sometimes C. Never

   Comments: _____

10. Would you take another course using the A-T system?

    A. Yes B. No

    Comments: _____

B. Course Evaluation:

11. I have taken this course:

    1/A To meet a college requirement.
    2/B Because it is required in my program.
    3/C Because it is in my major, but an elective.
    4/D As an elective course not in my major.

12. My classification is ("SPECIAL STUDENTS LEAVE ITEM 2 BLANK):

    1/A Freshman
    2/B Sophomore
    3/C Junior
    4/D Senior
    5/E Graduate

13. My sex is:

    1/A Male
    2/B Female

14. I am taking this course:

    1/A For a regular (A-F) grade.
    2/B Pass/NP.

Please use the following five-point scale to rate the A-T system. The rating indicates how this class compares with other classes you have had at ISU.

1/A Far below average (among the lowest 10%).
2/B Below average (among the next 20%).
3/C Average (among the middle 40%).
4/D Above average (among the next 20%).
5/E Far above average (Among the top 10%).

15. ORGANIZATION/EFFICIENCY - The course was well-organized and used available time efficiently.

16. ATTITUDE - The instructor was interested in and enthusiastic about teaching this class.

17. STUDENT INTEREST - The instructor stimulates student interest.

18. INTERACTION - The instructor was respectful, tolerant, and fair with the students.

19. EXPLANATION - The instructor explained the course material clearly.

20. EVALUATION - The instructor provided clear and appropriate procedures for demonstrating competency in the course.

21. Make any other comments on the bottom of this sheet.

APPENDIX I. TAPE DIALOGUE

Hello. This is Alan Murdoch. Welcome to Module #3 in the A-T Ski School. Today we are going to review some of the material from the first two learning modules and cover new material. Contained within this new material are ten basic points:

(1) Side slipping;
(2) Pole plant;
(3) Controlled-skidding turns;
(4) Wide parallel turns;
(5) Stem christy;
(6) Parallel skiing with exaggerated arm movements;
(7) Skid turns;
(8) Traverse;
(9) Skating turns; and
(10) General parallel skiing tips.

Let us begin with slide no. 1. This shows the position of your feet so that you can control the amount of slippage. By applying different pressure, you can actually cause the toes of your skis to grip more than the heels, or vice versa. To practice this, let us plant our poles and attempt to cause our feet to slide down the fall line. Depending upon the amount of edge set, we should also be able to control our speed of slide as well as our direction. By applying more pressure at the heels, the toes will go downhill more sharply. By applying more pressure, by leaning forward on the toes, the heels will go downhill more sharply. Attempt to keep your skis parallel in this exercise. It is also possible to ski forward and sidways simultaneously. This requires a little more balance and a little more practice.

Let us now look a little bit at the pole plant. We will cover this by starting in the traverse position, going across the fall line. As you prepare to make a turn, plant your pole after you have bent your knees and start to rise as the pole pushes you up. You should be able to develop a rhythm and at the same time allow your skis to sideslip down the hill. What we will do is several short turns simultaneously, all in the same direction. For the second turn, regain your weight, go into the traverse again, set your edges, plant your pole, and rise up. You should eventually be able to head up the hill. The next diagram shows what these sideslipping turns should look like on the edge of the hill.

To practice the pole plant in each direction, we will be on a small incline and attempt to keep our skis as close together as possible at the stage that we developed to last day. Bend the knees and prepare to plant the pole out at the tip of your right ski. You will be making a right turn after this pole plant.

You will notice that the pole is planted as the person is going to his lowest position, down. As he applies pressure and pushes up, the skis will become unweighted, and he is now ready to make a turn to the right. The same procedure is used in turning to the left. Prepare by bending, prepare to plant the pole, and continue.

Using the pole plant, we can sideslip and make several turns in a row. This sequence shows a skier making a turn, sideslipping all the way around, and preparing to plant the pole. You will notice as he starts the turn and allows his toes to remain in one line that his heels tend to slide a little more. Bending the knees and the slight lean forward will take the weight off the heels and place it more on the toes. As he goes around, he will bring his outside pole up and prepare to plant the pole. One thing to remember--try to always face down the fall line. This shows the final pole plant in preparation to go in the opposite direction.

Let us quickly review the stem christy from last day. We start in the snowplow position, or the wedge position as I referred to it last day. For a turn to the right, plant the right pole out at the tip, release the weight from the right foot, and place the right foot parallel to the left. Continue in the traverse position across the slope and prepare for the next turn. This shows the traverse from a different angle.

Notice the skier unweighting one ski and placing it over the other. To get the feeling for this, you can imagine that you are reaching for your left bootstrap. You should feel a slight pinching between the hipbone and your ribs on the left side. The harder you press, the more you're going to turn to the right. As you come around, you should begin to plant your pole at the tip of the unweighted ski. After the plant, unweight that ski enough that it actually comes off the snow with the exception of the tip, and set it back down beside the weighted ski and parallel. This, as I mentioned last day, is the final step prior to parallel skiing.

Of particular importance is the weighting and unweighting of the skis and coordinating the timing of this with the

pole plant. Let us look at this next sequence of slides and try to get the rhythm. First of all, you are in a straight running position. As you begin to plant your pole, bringing it up to the tip of the ski, you bend your knees and lower your weight down. Plant your pole as you begin to come up. Bring the other pole up in a similar movement and begin to go down. Plant that pole and allow the body motion to come up.

Here is a sequence showing the different movements and the appropriate pole plant. Note that the pole plant is on the inside of each corner. In other words, you turn in the direction or to the side that you plant the pole. Plant the right pole; you turn right. Plant the left pole; you turn left.

We are now ready to work on wide parallel turns. Attempt to keep your skis as close together as possible. We are now going to avoid, as much as possible, using the snowplow or the wedge. Think about your timing--down, plant pole, up, bring pole up, down, plant pole, up, and so on. This should be your sequence. Pole is coming up, weight down, plant pole, weight up, and turn. Bring other pole up, weight down, prepare to plant pole, plant pole, and turn. Bring pole up, weight down, prepare to plant pole, plant pole, bring it up, and turn. And continue this sequence until you have a definite rhythm developed.

In bringing your poles up, be sure to bring them at least as far as the tip of the ski. Let them swing freely and try to get a pressure down so that your movement will cause the ski pole to go back towards the heel of your ski, the tail of your ski. You will want to make this a fairly quick motion. Don't think about your pole plant too much and forget the rest of your skiing. All through this, your skis should have been fairly parallel.

If done correctly, your turns would have looked like this diagram. It shows the sideslip, bite, plant pole, skid turn, bite, skid turn, bite, skid turn, bite, skid turn. Comparable to the previous diagram, your pole plant is on the inside of each corner.

The next sequence shows what you will look like once you get your parallel turns down and your sequence of pole movements. It is called the Wedeln. What it is is a sequence of short turns initiated by the pole plant. Straight-line position, skis together. Start to get a rhythmic movement, combining your arms, pole plant, and ski

movement. Cause your hips to force your weighting and unweighting of skis. Your hips will go in the opposite direction of your pole plant. Try to get a rhythm just like a dancer. Since these turns are fairly quick, plant the pole quickly and make it a jabbing action. Don't be afraid to be aggressive. Plant that pole quickly, just as if you meant it. Make these short swing turns quick and not too wide. You will find that this is where you will develop your edge control and your rhythm of pole plant action. As you develop the Wedeln, you will be able to ski much better. It is an excellent method of warming up.

Always try to remember your traverse position. This is where you have your knees and hips toward your hill, up the fall line, your shoulders and upper body away from the hill so that the weight remains above the skis. Your ski poles should be pointed towards the hill. In this way you will be able to initiate all of your skiing movements.

Reviewing once again--skating is probably one of the best ways of developing your skiing muscles. You should now be able to coordinate your arm and ski movement. Rather than using two pole-pushing actions, alternate with the pole plant opposite to the foot. This, as well as anything, will develop your rhythm. You should be able to develop it to the extent that you can make your turns on the hill actually while you're skating.

We have now completed the basics for the beginning level of the A-T Ski School. Module #4 will include materials on trick skiing as well as materials on ski areas in the country. This is completely optional and can be taken at your own discretion. All A-T students will be allowed up to 5 hours of individualized instruction at Ski Valley. Most skiers should be able to complete this after three terms. The remaining two hours should be utilized, however, for review purposes and correction of errors. You should go now to 214 Beyer and take the written test for the A-T Ski section, Module #3. Thank you. Good luck. Think snow. We'll see you on the slopes.

APPENDIX J. LIST OF VARIABLES

Audio-Tutorial	- A.T
Lecture/Lab	- L/L
Pretest exam	- PRSCR
Posttest exam	- PTRSCR
High School Rank	- HSR
Grade Point Average	- GPA
Attendance Frequency	- AFREQ
Attendance Duration	- ADUR
Pretest Body Weight	- PBW
Posttest Body Weight	- PTBW
Sex	- F-1, M-2
Pretest Weight Lifted	- PWL
Posttest Weight Lifted	- PTWL
Year in School	- YRS
Football Officiating Skill Evaluation	- FOSE
Archery Target Score	- ATSCR