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Learning activity packages vs audio-tutorial instruction as a vehicle for teaching physical education administration

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Learning activity packages vs. audio-tutorial instruction as a vehicle for teaching physical education administration

by

Lonnie D. Timmerman

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INTRODUCTION

The decline of the formal lecture as the principal mode of instruction in education at all levels can hardly be lamented. Researchers have shown other methods to be equal to or superior to the lecture in acquisition of factual material, but also superior in other more subjective ways. Two methods of instruction which have received attention in recent years are Learning Activities Packets (LAPs) and the Audio-Tutorial Package methods of instruction.

Although formal research is still scarce, the success of properly written and properly administered Learning Activities Packets and of the Audio-Tutorial Package methods can hardly be questioned as part of the solution to the eternal educator's problem of providing for individual interests and abilities of students. The development and use of these is based on two major premises, both of which have been validated by research (Manatt and Meeks, 18, p. 174):

1. Students learn at different rates.
2. Learning is incremental.

The most reknown attempts at programmed learning, leading to the present-day situation, all audio-tutorial packages, were done at the college level by Postlethwait (Purdue), Ekresman (University of Illinois, Surdy (Kansas State Teachers College), Foth, Crabtree, and Schafer (Michigan State), and

others. These concerned primarily physical and natural science courses. Some other researchers have explored new areas, to include, for example school law in an education course, an audio-tutorial experiment (Stuck, 34) and orienting already experienced teachers, through Learning Activity Packets in the "New Design" (Meeks, 20).

A curious turn occurred somewhere in the development of programmed learning, either through Audio-Tutorial Packages or Learning Activities Packets, or whatever; the emphasis shifted from the college level to the high school or earlier level. This may be evidenced by the large number of learning activities packets being made available by commercial companies (such as the Modular Instruction Units of Dwight Allen, UNIPAC by the I/D/E/A Kettering Foundation, and the TLU of Westinghouse Learning Corporation). While it may be commercially more feasible to aim for the larger market of elementary and secondary schools, the educational logic of this lack of prepared materials for the college level is questionable, since college students should be particularly suited for the independent study and individualization that are key concepts of both Learning Activity Packets and Audio-Tutorial Packages. Nearly any college course now taught primarily through classroom lecture should be adaptable to one or both of these concepts, to the benefit of both student and professor.

Research has concentrated on showing the lecture to be less effective than either Learning Activity Packets or Audio-Tutorial Packages at various levels. No research has yet been found which compared the effectiveness of Learning Activity Packets and Audio-Tutorial Packages. It would appear that such research is long overdue. Perhaps researchers and developers of programmed learning are making the same mistakes made by the advocates of programmed instruction a decade ago.

> Programmed instruction research originally matched PI against conventional teaching. Between 1960 and 1964, 112 such comparative studies showed 41 percent of the programs to be superior; 49 percent, no difference; and 10 percent, worse. Such comparative research is to be avoided, however, because it makes no contribution to the improvement of instructional programming (12, p. 59).

Statement of the Problem

The problem of this study was to develop Learning Activity Packets and Audio-Tutorial Packages for four topics usually included in a college level course in Physical Education Administration on the college level and to evaluate the relative effectiveness of Learning Activity Packets as compared to the Audio-Tutorial Packages.

In order to evaluate the effectiveness of the Learning Activity Packets and Audio-Tutorial Packages, the following procedures were followed:

1. The fall and spring semester classes in Physical Education Administration at Drake University were the group used for the experiment. The group each semester was divided into two experimental groups, matching for sex and I.Q., then matching a member of group A with one of Group B, as closely as numbers would allow. The Henmon-Nelson Tests of Mental Ability, Revised Edition, Houghton Mifflin, 1961, were used as the measure of I.Q.

2. Each group then took the same pre-test for each of the topics before beginning either the Learning Activity Packet or the Audio-Tutorial Package for the topic. After the pre-test, each group studied the topic using either the Learning Activity Packet or the Audio-Tutorial Package, with the groups alternating the mode of study. For example, topic #1, Administration of Health and Physical Education, was studied through the use of the Learning Activity Packet by group A and the Audio-Tutorial Package by Group B. Group B then used the Learning Activity Packet for Topic #2 while group A used the Audio-Tutorial Package. All students worked independently of one another, and all took the same post-test for each topic.

Specifically, the problem of this study was to test the following null hypotheses:

1. There is no significant difference in the learning (as measured by the post-tests, after adjusting for pre-test differences if necessary) by using the audio-tutorial method and the learning activities package method of instruction, when students are grouped by mode.

2. There is no significant difference in the learning (as measured by the post-test after adjusting for pre-test differences if necessary) by using the audio-tutorial method and learning package method of instruction, when students are grouped by sex.

3. There is no significant difference in the learning (as measured by the post-test after adjusting for pre-test differences if necessary) by using the audio-tutorial package and the learning activity package modes of instruction when students are grouped by semester.

4. There is no significant difference in the learning (as measured by the post-test after adjusting for pre-test differences if necessary) by using the audio-tutorial package and the learning activity package of instruction when students are grouped by sex and mode.

5. There is no significant difference in the amount of time (as indicated by a record of time) required to complete the learning activities package and the audio-tutorial package.

Terminology

Learning Activity Packet: Written materials developed to teach a concept or skill. The package's components are (1) the stated concept, (2) pre-test, (3) behavioral objectives, (4) learning activities, (5) quest activities, and (6) post-test. A package is to be self-instructional requiring very little direct teacher supervision. It may be self-contained or it may require many supporting aids such as periodicals, books, and audio-visual aids. It is a guide for students to use in learning.

Audio-Tutorial Package: A type of Learning Activity Package where the directions to the student are recorded on a tape, and the student receives his instructions by listening to the tape. A selection of supporting materials may be included with the tape.

Pre-Test: An achievement test given to each student before beginning each Learning Activity Packet or Audio-Tutorial Package.

Post-Test: An achievement test given to each student immediately after all instruction has been completed.

Sources of Data

The data for this study were collected from the Fall and Spring semester classes in Physical Education Administration at Drake University. Four Learning Activity Packets were formulated, covering four topics pertinent to Physical Education Administration: Administration of Health and Physical Education, Office Management, Budget and Finance, and Purchase and Care of Supplies and Equipment. Four audio-tutorial packages were constructed over the same topics. Each student then had a pre-test score and a post-test score for each topic covered, whether the student studied via the Learning Activity Packet or the Audio-Tutorial Package.

For each topic, the average score of the group who studied via the Learning Activity Packet was compared using the student's t test and, if necessary, an analysis of variance after adjustment for pre-test differences.

The analysis of scores in this manner should give a cross-view of the effectiveness of the Learning Activity Packets and the Audio-Tutorial Packages with each student and each topic.

Delimitations

The delimitations of this study included the following:

1. The study was confined to the students enrolled in P.E. 198: Physical Education Administration, during either fall or spring semester at Drake University.
2. The four topics to be developed into Learning Activity Packets or Audio-Tutorial Packages were limited to those of Administration of Health and Physical Education, Office Management, Budget and Finance, and Purchase and Care of Supplies and Equipment.

Organization of the Study

The material of this study is organized into five chapters. The first chapter included the statement of the problem, terminology, delimitations, sources of data, and organization of the study.

Chapter two includes a review, summary, and analysis of related literature. This includes literature relating to programmed instruction, concentrating on learning activity packets and audio-tutorial packages and their effective creation and use, and on research relating to the use of these modes.

Chapter 3 discusses the procedures and methodology utilized in the study.

The results of the study and the discussion of these results are presented in Chapter 4.

In Chapter 5, the summary of the findings, conclusions, and recommendations for further study are presented.

REVIEW OF LITERATURE AND RELATED RESEARCH

Introduction

The search for better ways of educating students at all levels has been one of long standing. As the pace of our society and technology increases, changes also come ever more quickly in the field of education. The current vocabulary alone evidences the extent of recent innovations: team teaching, modular scheduling, LGI, computer-assisted instruction, dial access, programmed instruction. The focus of much of this effort is an attempt to solve the question central to teachers throughout the history of education: How to provide individualized instruction that allows for the differences in students that exist in any classroom. Recent technology and the increased awareness by society of the value of the individual have created renewed interest and encouraged the development of effective programs for individualization. Manatt and Meeks (19, p. vii) summarized the extent of these developments:

1. An awareness of and skill in specifying educational objectives.
2. Acceptance of the notion of self-instruction, self-initiation, and self-direction in learning.
3. Refinement of testing techniques that permit assessment in terms of specific goals.

4. Acceptance of differentiated responsibilities that permit instructional roles other than that of teacher.

5. Development of improved management skills that allow for proper record keeping and classroom management.

6. Awareness of the use of feedback data about the student as a contingency for motivation.

They continue: (19, p. viii)

> With the teacher's role changing to that of diagnostician, a selector of human and material resources and a tutor, self-instructional materials become a key ingredient in individualization.

The role of self-instructional materials in individualizing instruction is the primary focus of this review of literature and related research. The review is divided into the following sections: (1) Self-Instructional Materials, with particular attention to (2) Learning Activity Packages and (3) Audio-Tutorial Programs, and (4) Approaches to Teaching Physical Education. Research related to this study will be included in the appropriate section. The Summary (5) will end the chapter.

Self-Instructional Materials

The phrase "self-instructional materials" is most commonly associated with "programmed instruction," though the two are not inter-changeable. "Programmed Instruction" refers to some of the several modes of self-instruction, all of which have four basic characteristics: (6, p. 1018)

1. Focus the student's attention on a limited amount of material at one time.
2. Require response or answer to each segment.
3. Give immediate feedback after every response.
4. Permit the student to work at his own pace.

The basic purpose of all Programmed Instruction is to guide the learner so that a particular set of desired changes occur in his behavior.

In a more flexible interpretation which encompasses many of the most recent developments in programmed instruction, the objectives are: (6, p. 1019)

1. Every unit of behavior must be described.
2. The conditions under which the behavior is to occur must be stated.
3. The minimum acceptable level of behavior must be specified.

In addition, the psychological criteria for judging the adequacy of instruction must be described with respect to one or more of the following: rate of learning, the degree of retention, and the amount of retention.

Three types of measureable behavior are subjects for programmed instruction: (7)

1. Psychomotor, or muscular actions.
2. Cognitive, or knowledge.
3. Affective, or attitudes.

No matter what the subject of the program, three types of editing must be part of the construction process:

1. Editing for programming techniques.

2. Editing for composition.

3. Editing for technical accuracy.

A crucial factor in programmed instruction is the location of the responsibility for learning: (23, p. 6)

> In programmed instruction an entirely new concept of responsibility enters the learning situation. The burden of responsibility for the student learning is on the program and the instructional technology used--not solely on the student. If the student doesn't learn, something is wrong with the program...it must be revised until it teaches practically everybody.

Also of critical importance is the framing of appropriate behavioral objectives. The stating of goals in terms of student rather than instructor behavior was refined by Mager (18), but has had increasingly wide implications for all teachers, not only those involved in programmed instruction. The behavioral objectives lead to activities designed to foster appropriate practice. This may be manifested in several outlets. For example, Reisman sees one of the primary benefits of programmed instruction as that of developing materials for learners with different "styles of learning" (29, pp. 15-17). He outlines three styles: visual (reading), aural (hearing), or physical (doing things), commenting that while teachers focus on emotion, motivation, and personality as causes of failure to learn, they should be examining the <u>way</u> a student learns and works. This style is set during a child's early years, and is then not subject to change. The

teacher's job is to help the learner discover his style, its strengths, and limitations, and provide appropriate learning materials. In a class, this means several ways of achieving the same behavioral objective, a situation which would lead to some form of self-instructional materials.

Immediate knowledge of results is another characteristic of programmed instruction. Commonly called "feedback" or "reinforcement", knowledge of results is part of the reinforcement theory (Skinnerian psychology) developed by B. F. Skinner (31). Geis and Chapman (8), surveyed related research and found no clear relationship to why feedback is related to learning. They assume the correct interpretation is that reinforcement is related specifically to "the previous just response to feedback" rather than to the ambiguous term "learning." Printed answers are not globally and automatically a reinforcer. Geis and Chapman recommend a great deal of further research to determine how, when, and why knowledge of results becomes reinforcing and contributes to more effective learning.

Programmed instruction is not a panacea. Popham (27) warns against several possible misuses or abuses: attempting to program what is initially poor content, guilt of teachers when programmed instruction permits exceptional students to truly progress at their own rate rather than being tied to the teacher's concept of "average," reliance on poor programs,

and attempts to cut costs by spreading teachers too far using self-instructional materials.

The manifestations of programmed instruction are many: programmed texts, which can be adunctive, linear, mathetic, branched, or intrinsic; machine or book or computer-assisted, in a wide variety of subjects. Linear programmed textbooks are the most common format, but whatever the form, the students learn, and the students like it (6, p. 1020). Stolurow concludes: (6, p. 1020)

> The decision to use programmed instruction in and for education is not simple or easy, but any doubts about its permanence or effectiveness would have to stem from prejudice or ignorance. The only course of action for areas of application is how to use programmed instruction most effectively, and the only course for research is how to improve upon what little we now know so that we can begin understanding teaching and learning as they take place in schools, universities, and training establishments.

Advantages of programmed instruction, true of any level but specifically referring to the college level, were outlined by McIntyre: (16, pp. 85-91)

1. Superior teachers can be spread around.
2. More personal contact between teacher and learner is possible.
3. Teaching can be enriched.

McIntyre says the question is no longer if media and programmed instruction are to be used, but how and when to use which medium. He points out that colleges and universities are behind the lower educational levels, that students coming

to higher education are familiar with programmed instruction and extensive use of media.

Research related to programmed instruction has elicited several conclusions pertinent to this study and to literature already cited. Dubin and Taveggia report that: (5, p. 35)

> Data demonstrate clearly and unequivocally that there is no difference among truly distinctive methods of college instruction when evaluated by student performance on final examinations.

They conclude: (5, p. 49)

> Since there are no differences among a wide range of teaching technologies we may assume that their respective benefits are equal. This, then, turns the attention in cost-benefit analysis to the cost side of the issue.

In support of this, Bartz and Darley (2), summarized a study of four groups taking freshman math at Purdue University. The four modes of instruction were: (1) formal instruction, (2) supervised programmed instruction, (3) non-supervised programmed instruction, and (4) no instruction. There was no significant difference in achievement. Time-wise, supervised programmed instruction was as efficient. Many other studies could be summarized, but the point is that there is wide difference of opinion concerning the effectiveness of programmed instruction. Some explanation for this may be found in research by Tracy (36) and Davis et al. (4). Tracy, after a study which grouped students into Honors and Ability I groups, concludes that:

> Self-sufficiency is related to achievement in an independent situation on tasks requiring students to analyze and draw conclusions but not on tasks requiring knowledge of specific facts.

Students in the experimental groups also felt that individual learning was more difficult and more time-consuming, and that they learned less. Davis et al. (4) looked at the problem from another point of view; he assumed that, because of individual differences, some students may learn better with one mode while another mode may be more effective with another student. Traditional statistical measures of central tendency would mask this phenomenon. Davis concludes that measures of individual difference may be useful for prescribing instructional treatments.

Learning Activity Packages

Learning Activity Packages are a comparatively recent development in programmed instruction. A LAP is a "modular instructional unit designed to facilitate the individualization of instruction" (19, p. 174). A specific advantage of the LAP is that it allows the student a wide variety of choices in how he will achieve the behavioral objectives, thus allowing for differences in past achievement and in style of learning. Instructional packages began as a supplementary mode, but are increasingly becoming a kind of comprehensive system with the following characteristics: (15)

1. They emphasize individualization.
2. They incorporate the multi-media concept.
3. They minimize dependence on the teacher.

As in all self-instructional materials, LAPs attempt to account for differences in pupil learning rate, past achievement, interest, and aptitude. LAPs do not require everyone to go through every activity.

LAPs are based on the premises that students will learn better if they are: (35, pp. 20-21)

1. Told what they are to be able to do as a result of the learning experience (behavioral objectives).
2. Given a set of learning experiences which help them to learn to do what they are to be able to do.
3. Are then asked to demonstrate that they are able to do it.

The LAP forces the teacher to organize the learning experience into a logical and consistent approach; he can then readily prepare performance criteria because there are clearly defined goals.

The LAP has five essential elements: (19, p. 174)

1. Concepts.
2. Behavioral objectives.
3. Multi-dimensional learning materials and activities.
4. Pre-, self- and post-evaluation.
5. Quest or self-initiated learning.

The components of a LAP are highly structured but not

at the expense of individualization. Furthermore, the teacher is an integral, but not the essential part of learning (32).

There are three major procedures for evaluation in a LAP: (11, pp. 178-183)

1. Exemption: The student may decide, after reading the behavioral objectives, that he already knows the material. If he passes the test, he may proceed to the next LAP.

2. Student self-assessment: Answers to these self-tests are readily available.

3. Teacher test: This must be parallel in content, form, and type of question to the student-self-assessment test.

Jones lists several factors involved in a LAP. One is the provision for small group work and for student/instructor contact. He adds: (11, p. 183)

> Many other elements may be included within the covers of a LAP: visual aids, a complete bibliography, work sheets, an achievement record, and a large dose of motivational drawings, anecdotes, and cartoons. The insertion of these items is limited only by the imagination of the writer and the availability of time to think them up and write them down.

Quest opportunities may be one of three types: (1) apply knowledge gained and skills developed in some kind of activity which the student finds particularly interesting, (2) develop further the theoretical competencies in some area of interest, or (3) organize some type of activity which he designs himself.

The importance of behavioral objectives is again emphasized. Mager (17) states that the existence (or lack of) clearly-stated objectives may cause an approach (or an

avoidance) response. A positive response causes a rise in stimulation, self-esteem, and confidence. He approves of the LAP because the student may choose the extent and rate of his progress, may clearly see the objectives and goals, and can follow, through evaluation, his own progress.

Because of its characteristics and flexibility, Olsen (24), among others, sees LAPs as eventually replacing the conventional textbook or the current concept of a programmed text, both of which require all students to have virtually the same experiences. The commercial success of LAPs appear to justify this generalization. Among the commercial products are the UNIPAC (I/D/E/A Kettering Foundation), IPI (Individually Prescribed Instruction) by Bob Scanlon of RBS Inc., and the TLU (Teaching Learning Unit) of the Westinghouse Corporation (19).

Because of their recency, little research has been conducted using the strictly printed LAP. Meeks (20) noted this absence in the background information for the study of the effectiveness of LAPs compared to that of the lecture. He grouped 144 experienced teachers into two groups, one receiving instruction through LAPs and the other by attending lectures. The group using the LAPs achieved at a significantly higher level (.10 level of significance), than did the control group. There was no significant difference in time spent, but the experimental group indicated they preferred the LAPs to the

conventional lecture.

Audio-Tutorial Packages

An audio-tutorial package is a LAP with materials and facilities to supplement a written package. Most commonly, the instructions, objectives, and body of the LAP are recorded into an audio-tape. S. N. Postlethwait (28), a biology professor at Purdue University, has been a pioneer in the use of audio-tutorial instruction. Beginning as an attempt to help freshmen with deficient backgrounds in botany, the approach developed by Postlethwait is now used to teach all the sections of botany and is available commercially. Postlethwait began with supplementary tapes and gradually added diagrams, living samples, photographs, etc., until a complete learning kit was developed. Though no significant difference was found in achievement, the students felt they had a better understanding of the material and had higher motivation.

A study of the University of Michigan divided freshman psychology students into three groups, each of which received a different mode of instruction over the same material: (1) recitation-drill, (2) group-discussion, and (3) tutorial-study. In order to diminish the effect of individual teachers, a composite committee developed the quizzes, discussion questions, and materials for the tutorial

group. All groups took the same three objective tests. No significant difference was found in any of the three methods. Guetzkow, Kelly, and McKeachie (10) concluded, though, that at least two factors should be investigated further:

1. The course still emphasized content acquisition. Perhaps the ends as well as the means should be questioned.
2. No provision was made to check on difference in the retention of learning of the students.

Several studies besides Postlethwait's have been done concerning audio-tutorial programs. Those with particular implication for this study are surveyed here. After developing an audio-tutorial approach to teaching an elementary agronomy course at Iowa State University, at least two reports were published. Lee (13) concluded that the audio-tutorial method was superior to the conventional lecture-and-laboratory arrangement. The audio-tutorial group spent 6.07 per cent less time, achieved better on laboratory quizzes, and had fewer students drop the course. He also concluded that audio-tutorial program had the following additional benefits: (13, pp. 45-46)

1. Once the initial materials were developed, the teaching staff had more time than in the past to improve teaching materials and methods.
2. The audio-tutorial laboratory instructor was available to help the students as problems arose, rather than discussing the laboratory subject matter before the student was fully aware of its importance.
3. Minimal problems for makeup and review.

4. Fewer class scheduling problems.

5. The audio-tutorial lab offered more flexibility in handling increases in increases in enrollment.

Green, reporting on the same study, felt that the success of the audio-tutorial program depended on: (9, p. 55)

1. Brief concise instructions at each station.

2. Good study materials at each station.

3. Enough stations so that the students can have ample space for study.

4. Classrooms which can be kept open all day and possibly evenings.

5. Laboratory instructors who are willing to give up the lecture method of presentation and walk several miles during each laboratory period "hipping" at lazy students, challenging the fast students, and answering questions needed.

Several other studies have also been done on the college level with other agriculture and science courses. Stuck (34) used simulated materials and audio-tutorial programs to teach a unit of school law to a senior-level college education course. He analyzed that data for significant difference in achievement level related to the following variables: whether or not student teaching had been completed, group (Audio-Tutorial or lecture) and retention. The only significant difference was in the group. The audio-tutorial group achieved significantly better than the lecture group and spent 38.44 per cent less time.

All researchers found have concluded that the audio-

tutorial method was superior to the lecture method, though their reasons may have differed.

Approaches to Teaching Physical Education

Criticism of physical education programs has become increasingly widespread in recent years, as students at all levels decry the lack of individualization, the alleged uselessness of required physical education, and the lack of instruction which will have life-long benefits. Many physical education professionals have been aware of these problems and have acted accordingly. Among the proposed and implemented solutions have been "life sports only physical education requirements" (30, p. 28), increased emphasis in recreational and fitness and coed classes (25, p. 32), and increased attention to the aspects of grading (33, p. 34), such as what to grade, how to rate improvement, effort, attitude. Angell (1) says that physical educators are testing the wrong things, for the real benefits of physical education cannot be tested: personal identity, human worth, etc. Recent research and writing in physical education has concentrated on individualizing instruction and increasing the emphasis on these more intangible benefits. Mosston first challenges the traditional "command style" of teaching physical education--teacher demonstration and explanation, student execution and/or

imitation, and finally teacher evaluation--then asserts that the emphasis must be as follows: (21, p. x)

> (Mosston) places emphasis upon becoming, rather than on performing--upon flexibility, rather than upon rigidibility--and upon change rather than upon dogmatism. Education is viewed as a planned series of dynamic behavioral interactions between teacher and child. The starting point is the kind of behavior one might wish the child to evidence in a free society.
>
> Learning is not described in the usual sugar-coated terms, but rather is presented as a struggle to be resolved--and in the resolution comes the realization--the personal triumph of the learner. By skillfully blending concepts advanced by Maslow, Skinner, Bruner, and Socrates into meaningful and workable formulas, a flexible framework is offered to those sensitive enough to grasp it. It is suggested that true learning is only accomplished by carefully transferring decisions formerly made by teachers to the learner.

Trump (37, p. 7) says the "New Design" can be applied to physical education as well as "academic" courses. This would include large group lectures by experts in the field, small group discussions, and independent study in health, fitness, and recreation learning resource centers.

The use of programmed instruction to teach physical education motor skills has been limited but with encouraging results. Locke surveyed seven studies which used programmed instruction, six of which used a programmed textbook. He concluded: (14, p. 57)

> Motor skills can be programmed and that programmed instruction of motor skills may be at least as effective as conventional methods of instruction.

In no case was the conventional method superior. However, Locke raises some speculation which has application to all programmed instruction: (14, p. 59)

> It does not seem out of order to speculate that many statistically significant differences favoring programmed instruction might be attributed less to the superiority of programming, and more to the inferiority of the traditional verbal-based instruction used as a control condition. Such traditional methods are not inherently inferior but teachers rarely prepare traditional instruction with the same thorough attention to pedagogical detail that goes into the construction of a programmed text.

Summary

The Review of Literature and Related Research disclosed several points of interest to this study. The research reported thus far is far more provocative than definitive. The course involved in this study is part of the sequence for teacher education in physical education. Therefore the use of LAPs and audio-tutorial instruction serves the dual purpose of providing material whose content is itself valuable to the prospective teacher, and of introducing the student to a format which is of importance to the student as a future teacher.

As Brown asserts: (3)

> If anyone is effectively to change the classroom behavior of teachers, he must also change their beliefs. There is no objective evidence that tells us the kind of competencies that all teachers should have or the kind of preparation required to develop such competencies. Yet, we go about training teachers as if there were some sort of universal consensus, supported by an irrefutable body of theory and research, regarding 'one best' definition of good teaching and 'one best' teacher education program.

METHODS OF PROCEDURE

This chapter outlines the procedures used to prepare the material, administer the pre- and post-test, and selection of the population sample.

Preparing the Materials

The rationale for the preparation of the individualized materials is the reinforcement theory usually credited to Skinner (31). His reasoning is that in developing an instruction system first the responses or behavior desired must be analyzed. Then materials are developed to reinforce the student's behavior as it approximates the desired behavior. The use of programmed modes of instruction also permits each student to determine for himself how much repetition he needs. In addition, LAPs and ATPs permit the student to isolate himself from the surrounding environment, permitting greater concentration.

The student's needs were assessed in four areas taught in Physical Education 198 "Administration of Physical Education". The four packets were entitled "The Care and Purchase of Supplies and Equipment", "Budgeting", "Systems and Procedures for Efficient Office Management" and "School Health Programs". The writer, having taught the course for two years, selected the four areas as outlined as important areas of the course dealing with relatively concrete topics, well-

suited to LAP's and ATP's.

Each of the packages, both audio and written, included behavioral objectives, pre- and post-test, information section, text and audio-visual media, and enrichment activities.

Objectives

The objectives were designed in relation to the results of teaching and specifically testing in the course Physical Education 198. The objectives were rewritten for the student to understand what he must accomplish in order to progress. Each objective strived to be formulated by recognizing (1) The Learner, (2) The Situation, (3) Behavior, (4) Conditions, and (5) Standards.

The objectives for each unit were formulated as follows:

Unit I: Systems and Procedures for Efficient Office Management

General Objectives:

1. You will be taught the responsibilities and duties of the administrator and personnel of the Physical Education Department, and you will be tested over these duties and responsibilities.

2. You will compare Physical Education offices of small and large high schools, colleges and universities, by using the text and knowledge gained from field trips.

3. The student will be involved in constructing good office procedures, having access to the text and other information.

Behavioral Objectives:

1. We expect you to gain an insight of the general floor plan and equipment necessary in the office. At the end of the LAP you will be able to list the equipment and describe the general floor plan.

2. The student will learn ways to record and file such items as records, reports, and correspondence with accuracy while working in the classroom setting.

Unit II: The Care and Purchase of Supplies and Equipment

General Objectives:

1. At the termination of this LAP, the student will be able to select the best item for his particular school needs from a number of similar items.

2. You will know and carry out the proper procedures for storing athletic equipment when not in use.

3. Presented with the need of purchasing, you will be able to evaluate your departmental resources and know from whom to purchase quality merchandise while staying within your budget.

Behavioral Objectives:

1. Having studied equipment care in class, the student will be able to recognize four of the values of good maintenance on equipment.

2. Using the lecture information and charts, the student will be able to determine the best repair method for a given situation of a particular school.

3. Given a multiple-choice, matching, true-false, and essay test, the student will be able to describe the proper procedures for ordering and securing equipment as required by a physical education or athletic department of a particular school with 80% accuracy.

4. Given the principles of marking equipment, you will be able to devise a scheme for marking equipment under your care.

Unit III: Budgeting

General Objectives:

1. Participating in discussions with the head of the department of physical education, the procedures for adoption of the budget will be accumulated.

2. Presented with the proper information, the individual will know the difference between the two principal types of budgets, capital and operating. He will also know the two patterns budgets follow: a blanket budget or a line budget.

Behavioral Objectives:

1. Given the proper procedures, the learner should be able to prepare an acceptable budget.

2. Upon reviewing articles and chapters from other books, one will know how the Physical Education program receives financial support.

3. By working with inventory sheets, budget forms, and statements, the student will better understand the auditing and bookkeeping pertaining to budgets.

Unit IV: School Health Programs

General Objectives:

1. The learner will know the individuals involved in the school health program.

Behavioral Objectives:

1. To be able to state and know the three divisions of the school health program.

2. The learner should be able to make a list of the aims of health education.

3. The learner will be able to list the five patterns for health content and individually select the most important one.

4. The learner should be able to list the elements of the school appraisal.

Pre- and post tests

Pre- and post-tests were designed for the four subject areas. Each of the tests was twenty-five questions in length. The questions were assigned to a particular test by a table of random numbers.

An item analysis was performed on each test by the Classroom Examination Scoring and Analysis Service, Iowa State University.

Tables 1 through 4 show the item analysis of each of the four units. In all cases the number of items scored was twenty-five, with thirty-nine students taking the test. For each unit test a reliability estimate was computed, then the error variance, the standard error of measurement for raw scores and T scores, and the mean variance and standard deviation. These were computed for both pre- and post-test scores.

Reliability indicates the ability of the test to consistently measure what it is purported to measure. The closer the reliability is to 1.0, the better the test will measure. Error of measurement is closely related to reliability and indicates the difference between complete accuracy and the actual measuring ability of the test. For example, given a test with 25 items and an error of measurement of 2, a person who scored 18 would have a true score of 18 plus or minus the error of measurement, or a true score in the range of 16-20. In order to improve the measurement characteristics, either

Table 1. Item analysis of test items pertaining to Unit I: The Care and Purchase of Supplies and Equipment

	Pre-Test	Post-Test
Reliability estimate	0.32	0.38
Error Variance	4.00	2.79
Standard Error of Measurement in Raw Scores	2.00	1.67
Standard Error of Measurement in T Scores	82.72	75.58
Number taking test	39	39
Mean	11.72	19.13
Variance	5.84	4.52
Standard Deviation	2.42	2.13
Number of Items Scored		

additional items may be added to the test or the quality of the existing items may be improved (27).

Table 1 indicates a reliability estimate of 0.32 for the pre-test and 0.38 for the post-test, with an error variance of 4.00 and 2.79, respectively. The mean for the pre-test was 11.72, while that for the post-test was 19.13 with a variance of 5.84 for the pre-test and 4.52 for the post-test and a standard deviation of 2.42 and 2.13.

The item analysis indicates that the post-test was a more reliable test than the pre-test, though higher reliability estimates would be desirable for both.

In Table 2 is shown the item analysis of Unit II. The reliability decreased from 0.39 in the pre-test to 0.30

Table 2. Item analysis of test items pertaining to Unit II: Systems and Procedures for Efficient Office Management

	Pre-Test	Post-Test
Reliability Estimate	0.39	0.30
Error Variance	4.05	2.92
Standard Error of Measurement in Raw Scores	2.01	1.71
Standard Error of Measurement in T Scores	77.92	83.90
Number Taking Test	39	39
Mean	15.28	18.56
Variance	6.66	4.14
Standard Deviation	2.58	2.04
Number of Items Scored	25.0	25.0

in the post-test, with declines of 4.05 to 2.92 in error variance. The mean, however, increased from 15.28 in the pre-test to 18.56 in the post-test with a standard deviation of 2.58 and 2.04 respectively. The reliability estimates are again lower than desirable. This should be remedied in revisions.

The data in Table 3 shows the item analysis for Unit III: Budgeting. While the reliability estimate increased from 0.08 to 0.19, the mean declined from 16.28 in the pre-test to 15.56 in the post-test. The standard deviation was 1.99 in the pre-test and 2.23 in the post-test. The

Table 3. Item analysis of test items pertaining to Unit III: Budgeting

	Pre-Test	Post-Test
Reliability Estimate	0.08	0.19
Error Variance	4.27	4.00
Standard Error of Measurement in Raw Scores	2.07	2.00
Standard Error of Measurement in T Scores	104.06	89.81
Number Taking Test	39.0	39.0
Mean	16.28	15.56
Variance	3.95	4.96
Standard Deviation	1.99	2.23
Number of Items Scored	25.0	25.0

reliability estimate for Unit III is extremely low for the pre-test. The post-test reliability estimate is somewhat higher, but still lower than expected. The low reliability estimate makes conclusions regarding the true means of the tests questionable. The reliability estimates of 0.43 for the pre-test and 0.55 for the post-test are by far the highest of the four units. These estimates, combined with the difference of over three points between the pre-test and post-test means reveal that the unit was the most effective of the four in terms of reliability.

Table 4 shows the data relating to Unit IV: School Health Programs. Again, the reliability estimate increased

from 0.43 in the pre-test to 0.55 in the post-test. The mean increased from 15.28 to 18.62 and the standard deviation declined slightly, from 2.73 in the pre-test to 2.71 in the post-test.

The reliability estimate, ranging from .08 in the pre-test of Unit III to a high of .55 in the post-test of Unit IV is not as high as might be desirable. However, high reliability of tests of a relatively homogeneous group is difficult to achieve, as noted by Popham (26). It is assumed that a group of senior college students majoring in Physical Education enrolled in a course in their major field would constitute such a homogeneous group.

Table 4. Item analysis of test items pertaining to Unit IV: School Health Programs

	Pre-Test	Post-Test
Reliability Estimate	0.43	0.55
Error Variance	4.23	3.30
Standard Error of Measurement in Raw Scores	2.06	1.82
Standard Error of Measurement in T Scores	75.40	66.96
Number Taking Test	39.0	39.0
Mean	15.28	18.62
Variance	7.43	7.37
Standard Deviation	2.73	2.71
Number of Items Scored	25.0	25.0

Information section

A short amount of material pertinent to each behavioral objective was included in each packet. The audio-packet contained more extensive material, due to the less expensive method of recording than in writing and duplicating.

Test and audio-visual media

Readings from various reference books, magazines, and papers were listed for the students to choose from.

At least one type of audio-visual media was available for selection for each behavioral objective.

Enrichment activities

A number of activities were listed for the student who wished to do more in-depth study in a particular area.

Description of the Population

During the 1971-72 school year, there were a total of thirty-nine students enrolled in the course "Physical Education Administration." All of the total group were physical education majors. There were eighteen persons enrolled during the first semester; twelve men and six women. During the second semester, there were twenty-one class members; sixteen men and five women.

Collecting the Data

The Fall and Spring semester classes in "Physical Education Administration" at Drake University were grouped for the experiment. Each semester the class was divided into two groups for initial treatment since a crossing was to be used for treatment by the ATPs and LAPs. One-half of the students were placed in each group. This initial pairing was done based on sex and I.Q. as closely as numbers would allow. The Henmon-Nelson Tests of Mental Ability, College Level, Revised Edition, Houghton Mifflin, 1961, were used as the measure of I.Q.

Table 5. Pairing of students by IQ and sex

Pair No.	Student No.	IQ (% ile) Verbal	Quant.	Sex	Student No.	IQ (% ile) Verbal	Quant.	Sex
First Semester								
1	1	14	01	M	2	29	18	M
2	3	37	37	M	4	30	20	M
3	5	41	47	F	6	39	42	F
4	7	40	44	M	8	44	55	M
5	9	53	74	F	10	51	70	M
6	11	55	77	M	12	54	76	M
7	13	58	81	M	14	58	81	F
8	15	61	85	F	16	59	82	F
9	17	61	85	M	18	63	87	M

Table 5 (Continued)

Pair No.	Student No.	IQ (% ile) Verbal	Quant.	Sex	Student No.	IQ (% ile) Verbal	Quant.	Sex
Second Semester								
10	19	02	08	M	20	06	13	M
11	21	29	38	M	22	38	19	M
12	23	38	60	M	24	44	39	M
13	25	32	63	F	26	72	56	F
14	27	36	65	M	28	76	56	M
15	29	72	72	M	30	72	60	M
16	31	68	77	M	32	79	83	M
17	33	88	68	M	34	77	86	M
18	35	88	92	M	36	89	76	M
19	37	90	93	F	38	88	94	F
	39	81	93	F				

Table 5 indicates the pairings of students by IQ and sex. Students were matched as closely as numbers permitted by sex and by the verbal and quantitative scores of the Henmon-Nelson Tests of Mental Activity. Eighteen pairs of students were arranged. The odd numbered student (#39) was included in item analysis and statistical analysis of the results, but was not paired with any other student. During the first semester 6 women and 12 men were enrolled, with 5 women and 16 men in the second semester. A wide range of ability as measured by the

Henmon-Nelson is indicated with verbal scores ranging from 14th percentile to the 90th percentile and a range of 01 percentile to 94 percentile quantitative scores. For each topic studied, one student of each pair used the LAP, while the other student of the pair used the audio-tutorial package. Each student used the LAP for two topics and the audio-tutorial package for two topics.

The students were assigned two written packages and two audio-tutorial packages. The person they were matched with used the opposite mode of instruction. At the onset of the experiment the students were asked to keep a record of the time they spent working on each of the four packages. The amount of time was then recorded on each post-test at the completion of the work in the packets.

During the explanation period of the instruction to students, they were asked to keep in mind that they would have the opportunity to tell which method of instruction they would have preferred had they had the opportunity to choose. Their choice was then recorded at the time of post-testing.

All four pre-tests were administered to all members of the class in the same hour. The students were given two weeks to complete the packets and were asked to work independently of each other. Each student did one activity from the package and chose the one he wished. The students were encouraged to make continuous progress at a learning rate they felt was good for

them and to see the instructor if they desired any kind of help with the packets.

Each student received two written packets and was given the information necessary to use the audio-tutorial packets which were to be used at the Drake University media science center.

Two weeks after the pre-testing day the students were given post-tests and asked to record the time they needed to complete the package and their preference in regard to mode of instruction in each packet. Having recorded the needed information the students were, as in the pre-test, given as much time as they desired to complete the post-test.

As discussed earlier, all tests were scored and an item analysis was acquired from the Classroom Examination Scoring and Analysis Service, Iowa State University. The data were coded on to sheets for key punching. The Iowa State University computation center form CC-001-0 was completed and approved for unsponsored time for processing the data. On May 2, 1972 account number I4617 with storage Type C269 was opened at the Iowa State University Computation Center.

A program to find means, standard deviation and t-values was computed. The data were analyzed for significant differences regarding the following variables: sex, mode of instruction for each of the four topics, and the interaction for each of the four topics with mode and sex. It was

originally intended that major area of study be included as a variable. However, all students proved to be physical education majors, so this factor had to be omitted.

The .10 level of significance was selected as appropriate for this study because of the new field of investigation involved.

FINDINGS

The findings of this study are based upon the results obtained by testing 39 students divided into 18 pairs with one extra student. One member of each pair studied via learning activity packages, while the other member used the audio-tutorial program for a given topic, then used the alternate mode of instruction for the next topic. All students were tested with the same pre-test and post-test.

The analysis of the data was done using the student's t test for group data (27, p. 130) and the t-test for correlated observations for paired data (27, p. 152):

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} \qquad t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2} - 2r\left(\frac{s_1}{\sqrt{n_1}}\right)\left(\frac{s_2}{\sqrt{n_2}}\right)}}$$

t = the value by which the statistical significance of the mean difference will be judged

$\bar{X}_1$ = the mean of group 1

$\bar{X}_2$ = the mean of group 2

s_1^2 = the variance of group 1

s_2^2 = the variance of group 2

n_1 = the number of subjects in group 1

n_2 = the number of subjects in group 2

r = the correlation between the scores of the two groups

To determine if the groups had similar knowledge prior to treatment t-tests were run on the difference of the pre-

test means. The statistics derived were significant in some instances. Therefore it was deemed necessary to calculate gain scores and treat the resulting gain scores with analysis of variance.

Null Hypothesis One: There is no significant difference in the learning (as measured by the post-tests after adjusting for pre-test differences if necessary) by using the audio-tutorial method and the learning activity package method of instruction, when students are paired by mode.

Table 6. Analysis by mode of Unit I scores[a]

	Written Group	t	Audio
Pre Test Mean	15.31	.82	16.00
Pre Test S.D.	2.54		2.86
Post Test Mean	19.63	3.11**	18.15
Post Test S.D.	2.65		2.50
Gain Mean	4.31	2.05*	2.15
PREFERENCE			
Written	9		12
Audio	10		7
MEAN TIME	73.21	1.37	85.00
S.D. OF TIME	43.06		40.21

[a]The care and purchase of supplies and equipment.

*Significant at .10 level.

**Significant at .01 level.

Tables 6 through 9 contain the analysis by mode of the data. It must be noted that the 39th student was omitted in the analysis because she could not be paired with another student using the alternate mode.

Table 6 reveals the analysis by mode of the results for Unit I. The data show a slightly higher score (16.00 compared to 15.31) but not significant difference in the pre-test means for the group using the audio-tutorial package when compared to that of the group using learning activity packages. This difference was reversed for the post-test means, with a mean score of 19.63 for the learning activity package group and 18.15 for the audio-tutorial group. This difference in post-test means was significant at the .01 level. The difference in gain means of 2.16 was significant at the .10 level. Of the 19 people using the LAPs, 9 preferred the written format of the learning activity package, while ten indicated a preference for the audio. Of the 19 who used the audio-tutorial package, 12 would have preferred the learning activity package, while seven preferred the audio-tutorial package. The mean time of 85.00 minutes for the audio-tutorial package group was somewhat higher than the mean time of 73.21 of the learning activity package group. This difference was not significant.

Presented in Table 7 is the analysis by mode of the scores of Unit II. The pre-test means of 16.00 for the written group

and 15.89 for the audio group were nearly identical, while the post-test means of 14.73 for the learning activity package group and of 17.00 for the audio-tutorial package group were significantly different at the .01 level. The mean gain of 2.47 of the written group was significantly different when compared to that of 3.84 for the audio group. Those using the audio-tutorial package gained significantly more than those using the LAP. The difference in mean time spent was not significantly different. Of the 19 people using the

Table 7. Analysis by mode of Unit II scores[a]

	Written Group	t	Audio
Pre Test Mean	16.00	0.17	15.89
Pre Test S.D.	2.00		2.08
Post Test Mean	14.73	3.86**	17.00
Post Test S.D.	1.97		2.26
Gain Mean	1.26	2.52*	1.10
PREFERENCE			
Written	12		15
Audio	7		4
MEAN TIME	45.05	.87	82.10
S.D. OF TIME	48.63		50.25

[a]Systems and procedure for efficient office management.

*Significant at .10 level.

**Significant at .01 level.

learning activity package, twelve preferred the written form to the audio-tutorial package, while 15 of the 19 using the audio-tutorial package indicated a preference for the learning activity package.

Table 8. Analysis of mode of Unit III scores[a]

	Written Group	t	Audio
Pre Test Mean	15.84	.73	15.31
Pre Test S.D.	2.04		3.25
Post Test Mean	18.31	1.17	19.15
Post Test S.D.	2.54		1.67
Gain Mean	2.47	1.48	3.84
PREFERENCE			
Written	13		12
Audio	6		7
MEAN TIME	81.05	.96	88.94
S.D. OF TIME	41.52		40.33

[a]Budgeting.

Shown in Table 8 are data related to the analysis by mode of Unit III. Again, the pre-test means for the two groups of 15.84 (LAP) and 15.31 (audio-tutorial package) were nearly identical. The post-test means were also very close, with a mean of 18.31 for the learning activity package and 19.15

for the audio-tutorial package. The difference in the gain mean was also not significant. Again the preference was for the written form, with 13 of 19 using the LAP preferring that mode, and 12 of the 19 using the audio-tutorial package indicating they would have preferred the learning activity package. Those using the ATP recorded significantly more time spent than did those using the LAP.

Table 9. Analysis by mode of Unit IV scores[a]

	Written	t	Audio
Pre Test Mean	15.57	.14	15.68
Pre Test S.D.	2.34		2.60
Post Test Mean	18.31	3.18**	20.00
Post Test S.D.	2.31		1.85
Gain Mean	2.73	1.85	4.31
PREFERENCE			
Written	13		10
Audio	6		9
MEAN TIME	71.84	1.81*	83.68
S.D. OF TIME	41.13		38.21

[a]School Health Programs.

*Significant at .10 level.

**Significant at .01 level.

Table 9 portrays the analysis by mode of Unit IV. The pre-test means were 15.57 for the learning activity package

group and 15.68 for the audio-tutorial package group. The post-test means were 18.31 and 20.00, respectively. These differences were significantly different at the .01 level. The difference in mean amount of time needed of 71.84 for the learning activity package and 83.68 for the audio-tutorial package group was significantly different at the .10 level. The difference in the gain mean - 2.73 for the LAPs and 4.31 for the ATPs - was not significantly different. When asked to indicate preference, 13 of the 19 using the LAP preferred the LAP, while 10 of the 19 using the audio-tutorial package would have preferred the LAP.

On the basis of the statistical analysis, the null hypothesis is rejected at the .10 level for Units I, II, and IV, and failed to be rejected at the .10 level for Unit III. Units II and IV showed a significantly larger gain for the audio group, while no such gains were noted for Unit III. Unit I was associated with significantly higher gain same for students using the LAP.

Null Hypothesis Two: There is no significant difference in the learning (as measured by the post-test after adjusting for pre-test differences if necessary) by using the audio-tutorial method and the learning activity method of instruction, when students are grouped by sex.

Of the 39 students in the population, 28 were men and 11 women. Table 10 shows the analysis by sex of Unit I gains.

Table 10. Analysis by sex of Unit I scores[a]

	Male	t	Female
Pre Test Mean	15.21	1.9005*	16.70
Pre Test S.D.	2.85		1.89
Post Test Mean	18.55		19.90
Gain Mean	3.464	.4262	2.909
Post Test S.D.	2.63		2.42
PREFERENCE			
Written	14		8
Audio	14		3
MEAN TIME	76.93	0.9377	92.50
S.D. OF TIME	40.24		48.95

[a]The care and purchase of supplies and equipment.

*Significant at .10 level.

The difference between 15.21 (men) and 16.70 (women) of the pre-test mean score was significantly different at the .10 level. After adjusting for pre-test differences, the post-test means were analyzed for significant differences. None were found. Of the men, 14 preferred the LAP and 14 preferred the audio-tutorial package, while eight of the women indicated a preference for the LAP and only three preferred the audio-tutorial package. The mean times of 76.93 minutes (men) and 92.50 (women) were not significantly different.

Differences classified by sex are described in Table 11, which shows the analysis of Unit II scores. While the women had a slightly higher pre-test mean of 16.20, compared to 15.90

Table 11. Analysis by sex of Unit II scores[a]

	Male	t	Female
Pre Test Mean	15.90	0.4740	16.20
Pre Test S.D.	2.13		1.62
Post Test Mean	15.79		16.20
Gain Mean	-0.286	0.6611	0.455
Post Test S.D.	2.44		2.20
PREFERENCE			
Written	18		9
Audio	10		2
MEAN TIME	79.52	1.4274	47.95
S.D. OF TIME	80.00		53.54

[a]Systems and procedures for efficient office management.

for men, this difference was not significantly different. After adjusting for pre-test differences, the post-test means of 15.79 (men) and 16.20 (women) were analyzed and also were found to be not significantly different. In preference, 18 of 28 men favored the LAP, while 9 of the eleven women preferred the learning activity package.

The data in Table 12 reveal a significant difference at the .10 level between the pre-test mean for the men of 15.10 and the women's mean of 16.90. Analysis of post-test scores after adjusting for the pre-test differences yielded no significant difference. Again, the women preferred the

Table 12. Analysis by sex of unit III scores[a]

	Male	t	Female
Pre Test Mean	15.10	2.2880*	16.90
Pre Test S.D.	2.73		1.97
Post Test Mean	18.52		19.30
Gain Mean	3.429	0.9089	2.455
Post Test S.D.	2.23		1.83
PREFERENCE			
Written	17		9
Audio	11		2
MEAN TIME	87.76	0.9643	74.50
S.D. OF TIME	41.18		37.60

[a]Budgeting.

*Significant at the .10 level.

learning activity package to the audio-tutorial package by 9 to 2, while the men preferred the LAPs by 17 to 11. The mean times of 87.76 (men) and 74.50 (women) were not significantly different.

The differences in pre-test means were again significant at the .10 level for Unit IV, as shown in Table 13. No significant difference was found in post-test scores after adjustment for pre-test differences was made. The women

Table 13. Analysis by sex of Unit IV scores[a]

	Male	t	Female
Pre Test Mean	15.17	1.8791*	16.80
Pre Test S.D.	2.30		2.49
Post Test Mean	18.79		20.20
Gain Mean	3.786	0.7408	3.000
Post Test S.D.	2.35		1.32
PREFERENCE			
Written	15		9
Audio	13		2
MEAN TIME	80.17	0.6535	72.00
S.D. OF TIME	41.57		32.25

[a]School Health Programs.

*Significant at the .10 level.

again preferred the LAP to the audio-tutorial package by 9 to 2. The men, however, divided nearly equally in preference, with 15 preferring the LAP and 13 preferring the audio-tutorial package.

After analysis of the data, the null hypothesis two regarding significant differences in learning when students were grouped by sex failed to be rejected.

Null Hypothesis Three: There is no significant difference in the learning (as measured by the post-test after adjusting

for pre-test differences) if necessary by using the audio-tutorial package and the learning activity package modes of instruction when students are grouped by semester.

Table 14. Analysis by semester of Unit I scores[a]

	First Semester	t	Second Semester
Pre Test Mean	15.44	0.3057	15.71
Pre Test S.D.	2.91		2.55
Post Test Mean	19.44	1.2023	18.43
Post Test S.D.	2.71		2.50
PREFERENCE			
Written	11		11
Audio	7		10
MEAN TIME	55.33	4.2643**	102.86
S.D. OF TIME	29.09		40.27

[a]The care and purchase of supplies and equipment.

**Significant at .01 level.

Table 14 shows the analysis by semester of Unit I. The pre-test means of 15.44 (first semester) and 15.71 (second semester) were not significantly different, nor were the post-test means of 19.44 (first semester) and 18.43 (second semester). The students of the first semester preferred the learning activity packages to the audio-tutorial packages by eleven to seven. The second semester students, however,

divided nearly evenly, with eleven preferring the LAP and 10 preferring the audio-tutorial package. The mean times of 55.33 for the first semester students and of 102.86 for the second semester students were significantly different at the .01 level.

Table 15. Analysis by semester of Unit II scores[a]

	First Semester	t	Second Semester
Pre Test Mean	16.17	0.5582	15.81
Pre Test S.D.	1.98		2.04
Post Test Mean	15.56	0.8471	16.19
Post Test S.D.	1.95		2.68
PREFERENCE			
Written	12		15
Audio	6		6
MEAN TIME	49.50	4.558**	105.48
S.D. OF TIME	23.85		50.07

[a]Systems and procedures for efficient office management.

**Significant at .01 level.

In Table 15 is portrayed the analysis by semester of Unit II scores. The first semester students had a pre-test mean of 16.17 and a post-test mean of 15.56, while the second semester group had a pre-test mean of 15.81 and a post-test mean of 16.19. When indicating a preference, the LAP was preferred by 11 of the 18 enrolled in the first semester and by 15 of 21 of

those enrolled second semester. The first semester spent a mean time of 49.50 on their mode (either audio-tutorial package of LAP), while the second semester recorded a mean time of 105.48. This difference was significant at the .01 level.

Table 16. Analysis by semester of Unit III scores[a]

	First Semester	t	Second Semester
Pre Test Mean	16.22	1.4786	15.00
Pre Test S.D.	2.29		2.86
Post Test Mean	18.72	0.0149	18.71
Post Test S.D.	1.56		2.57
PREFERENCE			
Written	10		16
Audio	8		5
MEAN TIME	60.83	4.0092**	104.52
S.D. OF TIME	32.95		35.03

[a]Budgeting.

**Significant at .01 level.

In the analysis by semester of Unit III, shown in Table 16, the pre-test means of 16.22 (first semester) and of 15.00 (second semester) were not significantly different, nor were the post-test means of 18.72 (first semester) and of 18.71 (second semester). Again, however, the differences in the mean times of 60.83 (first semester) and 104.52 (second

semester) were significant at the .1 level. The LAP was again preferred by 10 of the 18 enrolled during the first semester and by 16 of the 21 enrolled during the second semester.

Table 17. Analysis by semester of Unit IV scores[a]

	First Semester	t	Second Semester
Pre-Test Mean	15.89	0.7016	15.33
Pre Test S.D.	2.74		2.15
Post Test Mean	19.89	2.0989*	18.52
Post Test S.D.	1.37		2.60
PREFERENCE			
Written	10		14
Audio	8		7
MEAN TIME	49.17	5.9986**	102.86
S.D. OF TIME	23.02		32.62

[a]School health programs.

*Significant at .10 level.

**Significant at .01 level.

The analysis by semester of Unit IV is shown in Table 17. The pre-test means were 15.89 for the first semester and 15.33 for the second semester. The post-test means were 19.89 for the first semester and 18.52 for the second semester. This was significantly different at the .1 level. The difference of 49.17 for the first semester and 102.86 for the second semester

for recorded time was significantly differently at the .01 level. The preference indication again favored the LAP, by 10 to 8 for the first semester. The analysis by semester of the data resulted in the following: Null hypothesis three is rejected for Unit IV.

Null hypothesis three failed to be rejected for Units I, II, and III.

Null Hypothesis Four: There is no significant difference in the learning (as measured by the post-test after adjusting for pre-test differences) by using the audio-tutorial package and the learning activity package modes of instruction when students are grouped by sex and mode.

Tables 18 through 21 show the analysis by sex and mode for the four units. In these four tables, analysis was possible using only 13 matched pairs of men and 4 pairs of women. Two of the original pairs had to be excluded from this analysis because they were a pair matched male and female, and the extra woman was again omitted because she was not paired. Table 18 shows the analysis by sex and mode of Unit I. The pre-test means for the sexes were not significantly different, with the women achieving 13.00 and the men 15.30 for the audio mode, and the men scoring 14.92 and the women 16.25 for the written mode. The men who used the audio-tutorial package indicated a preference for the audio-tutorial package by 8 to 5, while the women indicated a preference for the LAP, 4 to 0. There was no significant difference in the mean times of

Table 18. Analysis by sex and mode of Unit I scores[a]

	Audio			Written		
	Male	Female	t	Male	Female	t
Pre Test Mean	15.30	18.00	.35(M)	14.92	16.25	1.58(F)
Pre Test S.D.	3.03	.81		2.87	1.70	
Post Test Mean	17.84	19.00	2.13(M)*	19.15	21.00	1.73(F)
Post Test S.D.	2.60	2.16		2.76	1.41	
Gain Mean	2.53	1.00	1.14(M)	4.23	4.75	7.83(F)**
PREFERENCE						
Written	5	4		9	2	
Audio	8	0		4	2	
MEAN TIME	88.86	77.50	1.75(M)	71.61	92.50	.77(F)
S.D. TIME	42.63	29.58		39.10	61.84	

[a]The care and purchase of supplies and equipment.

*Significant at the .10 level.

**Significant at the .01 level.

88.86 (men) and 77.50 (women). Of those who used the LAP for Unit I, 9 of 13 men preferred the LAP, while 2 of the 4 women using the LAP preferred the LAP. The difference in the men's pre-test mean of 14.92 and the women's mean of 16.25 was not significant. The men using the LAP achieved significantly higher (.10 level of significance) than did the men using the ATP. The difference in the post-test means (19.15 for the men and 21.00 for the women) was not significantly different. The mean times of 71.61 (men) and 92.50 (women) were not significantly different. The differences between men and

women were not significant. However, the women using the audio mode achieved significantly better at the .01 level than the women using the LAP. There was a corresponding difference in the men's audio-tutorial scores and the men's LAP scores. The women's superior achievement using the audio-tutorial packages is particularly interesting when it is also noted that when asked to indicate a preference, 6 of the 8 women chose the LAP.

Table 19. Analysis by sex and mode of Unit II scores[a]

	Audio			Written		
	Male	Female	t	Male	Female	t
Pre Test Mean	15.84	15.75	.39(M)	16.15	15.50	.15(F)
Pre Test S.D.	2.37	1.70		2.03	2.08	
Post Test Mean	16.69	18.25	2.69(M)*	14.69	15.50	1.84(F)
Post Test S.D.	2.46	1.50		1.93	2.51	
Gain Mean	.84	2.50	1.90(M)*	-1.46	0.00	1.13(F)
PREFERENCE						
Written	4	4		9	2	
Audio	8	0		5	2	
MEAN TIME	84.23	81.25	.84(M)	75.07	82.50	.07(F)
S.D. TIME	54.61	53.28		47.27	66.52	

[a]Systems and procedures for efficient office management.

*Significant at .10 level.

The analysis of Unit II by sex and mode is outlined in Table 19. The post-test means were 16.69 (men) and 18.25 (women) for the audio-tutorial students and 14.69 (men) and 15.50 (women) for the group using LAPs. None of these differences were significant. However, the difference in post-test scores of the men was significantly different at the .10 level between those who used the audio-tutorial package and those who used the learning activity package. Those using the audio-tutorial package scored significantly higher and also preferred the audio-tutorial package by 8 to 4. The women's scores for the two modes were not significantly different. Six of the 8 women preferred the LAP. Of those who used the LAP, 9 of the 14 men preferred the LAP. The mean times of 84.23 (men) and 82.50 (women) for the written group were not significantly different.

In Table 20 is delineated the analysis by sex and mode of Unit III. The pre-test means for the audio group of 14.61 (men) and 16.25 (women) were not significantly different. The pre-test means for the written group were not significantly different. The post-test means of 19.23 and 19.00 were not significantly different. The analysis of women by mode yielded no significant differences, nor did the analysis of men by mode. The means of the audio group were not significantly different. The times of the men and women were

substantially different, but there were no significant differences. The preferences of the audio group were for the LAP, 9 to 5 for the men and 2 to 2 for the women, while those using the LAP indicated that 8 of the 12 men would have preferred the audio-tutorial package, while all of the women preferred the LAP. The mean times, while the

Table 20. Analysis by sex and mode of Unit III scores[a]

	Audio			Written		
	Male	Female	t	Male	Female	t
Pre Test Mean	14.61	16.25	.48(M)	15.07	17.75	1.04(F)
Pre Test S.D.	3.45	2.63		1.80	.95	
Post Test Mean	19.23	19.00	1.71(M)	17.61	20.25	1.32(F)
Post Test S.D.	1.87	1.63		2.46	2.50	
Gain Mean	4.61	2.75	1.61(M)	2.53	2.50	.29*F)
PREFERENCE						
Written	9	2		4	4	
Audio	5	2		8	0	
MEAN TIME	94.32	83.75	.57(M)	88.46	61.25	1.65(F)
S.D. TIME	41.37	48.54		42.78	26.57	

[a]Budgeting.

women recorded more time spent than did the men in both modes, were not significantly different.

Table 21. Analysis by sex and mode of Unit IV scores[a]

	Audio			Written		
	Male	Female	t	Male	Female	t
Pre Test Mean	15.15	18.25	.54(M)	14.69	17.25	.82(F)
Pre Test S.D.	2.30	2.63		2.13	.95	
Post Test Mean	19.76	21.00	2.59(M)*	18.07	19.25	1.13(F)
Post Test S.D.	2.04	1.41		2.53	2.21	
Gain Mean	4.61	2.75	1.22(M)	3.38	2.00	.47(F)
PREFERENCE						
Written	8	2		4	1	
Audio	4	2		9	3	
MEAN TIME	86.53	78.75	1.03(M)	77.69	67.50	1.00(F)
S.D. TIME	39.33	48.02		44.79	25.98	

[a]School health programs.

*Significant at .10 level.

In Table 21, the analysis by sex and mode of the scores of Unit IV are portrayed. The difference in the pre-test mean of the men (15.15) and of the women (18.25) of the audio group were not significantly different. There was no significant difference in the pre-test group means of the written group when grouped by sex. The men of the audio-tutorial group

showed a significantly higher score (.10 level) than did the men using the LAP. There were no other significant differences in scores after adjusting for pre-test differences. The means for the women were 78.75 (audio) and 67.50 (written) while the men reported an average of 86.53 (audio) and 77.69 (written).

On the basis of the analysis of data, null hypothesis four is rejected in favor of the written mode for the women using Unit I, is rejected in favor of the audio mode for the men of Units I, II, and IV, and failed to be rejected for all other groupings.

Null Hypothesis Five: There is no significant difference in the time needed to complete either the learning activity package of the audio-tutorial package when the students are grouped by mode, by sex, by semester, or by sex and mode.

Null Hypothesis five failed to be rejected when scores were grouped by mode.

Null Hypothesis five failed to be rejected when scores were grouped by sex.

Null Hypothesis five is rejected at the .01 level when grouped by semester.

Null Hypothesis five failed to be rejected.

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The problem was to develop learning activity packages and audio-tutorial packages for four topics included in a college level course in Physical Education Administration and to evaluate (in an experiment) the relative effectiveness of the learning activity packages as compared to the audio-tutorial packages. Specifically, the following null hypotheses were tested:

1. There is no significant difference in learning (as measured by the post-test after adjusting for pre-test differences if necessary) by the audio-tutorial method or the learning activity package method of instruction, when students are grouped by mode of instruction.

2. There is no significant difference in learning (as measured by the post-test after adjusting for pre-test differences if necessary) by the audio-tutorial method or the learning activity package method of instruction, when students are grouped by sex.

3. There is no significant difference in learning (as measured by the post-test after adjusting for pre-test differences if necessary) by the audio-tutorial method or the learning activity package method of instruction, when students are

grouped by semester.

4. There is no significant difference in learning (as measured by the post-test after adjusting for pre-test differences if necessary) by the audio-tutorial method or the learning activity package method of instruction, when students are grouped by sex and mode.

5. There is no significant difference in the amount of time (as indicated by a record of time) required to complete the learning activity package or the audio-tutorial package.

The population consisted of 39 students enrolled in Physical Education Administration at Drake University during fall and spring semester. The students were divided into two experimental groups, matching first for sex and IQ, then matching a member of group A with one of group B, as closely as numbers would permit. All students took the same pre-test for each topic, then explored the topic using either the audio-tutorial package or the learning activity package as assigned. The students then took the post-test. The groups alternated modes of instruction so that each student studied two topics using the learning activity package and two topics using the audio-tutorial package.

The student's t-test was used to analyze the data, and analysis of variance was used to analyze the data where adjustment for pre-test differences was necessary.

The results of the study were as follows:

1. Null hypothesis number 1 (A-T vs. Learning Packages) was rejected at the .01 level for Units I and II, and IV and could not be rejected at the .01 level for Unit III. Units II, and IV involved a significantly larger gain in learning for the audio-group, while there was no such gain for Unit III. Unit I revealed a highly significant gain for students using LAPs.

2. The null hypothesis involving sex differences was not rejected. After adjusting for pre-test differences, there was no significant difference when students were grouped by sex.

3. The null hypothesis regarding semester enrolled was rejected for Unit IV. Students enrolled during the first semester achieved significantly better on Unit IV: School Health Programs, than did those enrolled second semester.

4. Null Hypothesis number 4 (sex differences and modes) was rejected in favor of the audio mode for women using Unit I; was rejected in favor of the audio mode for the men of Units I, II and IV, and could not be rejected for the other groupings. The women who used the audio-tutorial package scored higher than the women using the learning activity package to study Unit I, while the men using the audio-tutorial package achieved higher scores than the men using the learning activity packages to study Units I, II and IV.

5. Null Hypothesis 5 (elapsed time) was not rejected when students were grouped by mode or sex. It was rejected at the .01 level when grouped by semester. The students enrolled during the second semester spent significantly more time, regardless of mode, to study each topic.

Limitations

This study was limited by the size and nature of the sample; 39 physical education majors enrolled in Physical Education Administration at Drake University during fall or spring semester. Any conclusions drawn by this study should not be generalized beyond this group.

Only two methods of instruction were examined: learning activity packages and audio-tutorial packages. No other comparisons should be made.

Four topics were selected: The Care and Purchase of Supplies and Equipment, Systems and Procedures for Efficient Office Management, Budgeting; and School Health Programs. All are commonly included in the Physical Education Administration course, and all are comparatively concrete in the concepts taught. Conclusions and generalizations should be restricted to these topics.

Because of reluctance on the part of the researcher to contaminate the study by teacher intervention, no attempt was made to give students additional aid or reinformcement. The

possibility of the teacher aiding individual students when questions arise is normally cited as a strength of each of the modes but was deleted from this experiment design for control purposes.

It is not known to what extent the "halo" effect may have biased the results of this study. Since both groups were experimental, this should have minimized the effect. However, this factor may have been present and will be explored in greater detail in the following discussion regarding the highly significant differences in time spent by the second semester students as compared to the first semester students.

The sample size, especially the number of women, was very small. This makes generalizations based on sex tenuous at best.

The quality of the materials is an influential factor in any study of this type. All of the materials for the learning activity packages and audio-tutorial packages were developed by one professor. After using the materials, the instructor judged the validity was satisfactory. Nonetheless, improvements can always be made in any materials developed and more varied topics might have produced quite different results.

Pre- and post tests were also teacher-made - not Standardized. Commonly, such criteria have adequate validity but low initial reliability. This happened in this investigation and the tests will need considerable improvement prior

to subsequent research (especially the tests for Unit III).

The records of time spent were kept by individual students and were thus dependent on the accuracy and honesty of the experimental subjects.

Conclusions

Five null hypotheses were tested in this study. The results yielded no consistent pattern of one mode being "superior" to the other. The audio mode did yield significantly higher scores at the .10 level for Units I and II, and IV. For Units I, II, and IV, men, using the audio mode, scored significantly better than those using the learning activity package. The women using the audio-tutorial packages did better than those using the learning activity package for Unit I. Little difference in performance could be expected with Unit III because of the extremely low reliability of the measuring device.

The women indicated personal preferences for packages over audio modes by wide margins, and those women using the ATP spent substantially more time than those using the LAP. In general, the ATP's took longer to complete and did not have the commensurate achievement as measured by the post test. Perhaps LAPs were preferred because of the difficulty involved in omitting or skimming sections of the audio-tutorial package, while this is easily done with the LAP.

After adjusting for pre-test differences, there were no

significant differences in results when students were grouped by sex. However, because of the very low number of females, the differences must be generally attributed to the males. In the analysis by mode of instruction and by sex and mode, the scores of some of the women participating had to be omitted because no pairing with another woman was possible. The women participating consistently scored substantially higher than did the men, but the small number of women makes generalizations speculative. It is the observation of the instructor that the women enrolled usually excel in this course, but because of the consistently larger enrollment of men than women, perhaps the course has evolved into either one unconsciously designed for men where the women over-compensate to make up for the obvious numerical minority, or perhaps the women physical education major really is a better student than the male physical education major as evaluated by the type of test used in the LAPs and ATPs. This again supports the idea that additional allowances should be made for increased opportunities for individualization.

Ordinarily one advantage of individualized instruction is that the previous learning a student may have is recognized, and the student may concentrate on those areas where he is weak. This was not possible with the design used by this research except perhaps that students in the LAPs read

selectively.

The cause of the highly significant (.01 level) difference in the time spent, regardless of mode, between first semester and second semester students can only be speculative. Perhaps a sort of "halo" effect was operant as students from the first semester recounted their experiences to students who participated later. This may have caused the second semester students to put in more time in an effort to equal or surpass the first semester class. Their achievement, however, despite the time input, was not significantly better. Also, extra-curricular activities, especially fall sports, may have affected the time available to the fall semester students.

The women clearly preferred the LAPs, while the men divided more evenly. Perhaps the men preferred the ATP's because all of the reading was included on the taped lesson. It might be assumed that male physical education majors would react more favorably to a non-print mode of learning. The LAPs may also have been preferred by some because they were completely self-contained, and therefore did not require a trip to the media center, long uninterrupted periods of time, or the structured environment of a carrel.

A further limiting aspect of this research situation was that the instructor/researcher could not offer the immediate aid and reinforcement which are considered to be advantages of the LAP and ATP. Especially in the ATP situation, where the

teacher might expect to be immediately available should the student have need of him, this "teachable moment" aspect was lost.

It is difficult to weigh the relative importance of achievement, preference, and efficiency of time. Perhaps the most important conclusion of this study is that no one method is "best" for all students in all areas for all topics. No analysis of individual student's performance was done in this study. Perhaps one student will find the LAP most satisfactory while another--using the same criteria or different reasons--will use the ATP. Personal preference may be the single most important factor, and a variety of modes should be available for student and instructor choice. At present, no diagnostic device exists for determining how an individual student best learns a given topic. Until such a device exists, individual preference and its influence on motivation of the student, coupled with instructor advice, may be the most reasonable approach.

Recommendations for Further Research and Development

1. Examine the materials used in this study for possible revisions. The materials, periodically revised and up-dated, should be used to teach P.E. 198, and additional units should be developed and their effectiveness evaluated.

2. A long-term aspect should be added to evaluate the

comparative retention factors of the two modes. A retention test should be given after the post-test at various intervals.

3. Include in future research analysis of learning of individual students to attempt to truly recognize individual differences.

4. Should these materials be used again, a method of immediate reinforcement should be available to the student. An instructor should be present to answer any questions that might arise.

5. Attempts should be made to clarify student attitudes and preferences through the creation of a diagnostic device used in diagnosing student needs and information from this instrument could improve the materials.

6. Additional modes of instruction, i.e., individual study on readings, use of discussion groups, and peer tutoring should be explored as alternatives for these topics or additional topics. The entire course might eventually evolve into a variety of modes, according to the topic, each of which has been found effective for teaching that particular concept. Eventually it should be possible for each student, after consultation with the instructor, to develop a course of study using a combination of the different modes designed to meet his specific and unique previous learning, needs, ways of learning, time available, and special interests.

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