A STUDY OF THE EFFECTS OF MULTIMEDIA INSTRUCTIONAL TECHNIQUES ON A COLLEGE FRESHMAN LIBRARY ORIENTATION PROGRAM

By

EARL EUGENE WASSOM

Bachelor of Arts
Bethany Nazarene College
Bethany, Oklahoma
1950

Master of Arts
East Tennessee State University
Johnson City, Tennessee
1962

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of the Oklahoma State University
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Thesis Approved:

Victor O. Hornbostel
Thesis Adviser

Vernon Troxel

Gene L. Post

Edmon Low

N. N. Durham
Dean of the Graduate College

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CHAPTER I

STATEMENT OF THE PROBLEM

Introduction

Higher education in the United States has undergone many changes as philosophies, curricula, and purposes have been evaluated. It has had a long history of gradual and placid evolution. Today, the educational process is faced with a series of challenges that will affect the economics, the student population, the staff, and the methods of instruction in higher education. The United States Office of Education (55) reports that the number of students enrolled in colleges and universities has grown more rapidly than population as a whole during the twentieth century, and the trend seems likely to continue. It is estimated that the college-age population will triple between the years 1955 and 1975. The enrollment that has been projected indicates that 7 million will be in institutions of higher learning by 1970 and at least 9 million by 1975 as compared to 3.6 million in 1960. This increasing number of students clearly reveals a need to evaluate the methods of teaching that are being utilized today.

Educators are raising the following questions: Can the valid, traditional purposes of higher education, as well as

its new and emerging purposes, continue to be attained economically and effectively by the conventional media of communication? Will the uses of new media of communication contribute to the educative process and expand the usefulness of the existing teaching staff? Can the introduction of a master teacher into the large-group classroom help to heighten the involvement of students with their courses using newer media communications, without loss of quality?

General Nature of the Problem

As the enrollment of Oklahoma State University increases, the problem of providing adequate instruction in the use of the library becomes more acute each year. Many incoming freshmen come to college from small schools and communities that have not provided them with the basic skills in library usage. Furthermore, as the enrollment enlarges as a result of students transferring from junior colleges, further library orientation will become necessary for those upperclassmen who are unfamiliar with the library resources which are available to them on the university campus. Moreover, the arrangement of the university library has placed a heavier responsibility upon the student for locating his own materials in the open-stack system.

The traditional approach to provide library orientation includes released time in freshman English in which the students receive formal but limited orientation to the building and library procedures. This method is restricted to one

section during each orientation session and presents several disadvantages. It makes excessive demands upon the reference librarian, and also creates disturbance in the areas in which the group is touring and receiving verbal instruction. The task of providing such instruction to 4,000 freshmen is time consuming and lacks the quality necessary for a full orientation.

A second method of orientation is through the elective system. Students may enroll in the course Library Science 111, attend class one hour weekly, and receive one semester hour credit. This gives a comprehensive orientation on the freshman level but also has the common disadvantage of touring the areas as part of its curriculum. The seven sections receiving this instruction benefit greatly. However, this is but a small percentage of the freshman population.

The purpose of this study was to introduce a teaching technique which would facilitate library instruction and simultaneously make it available to larger sections of students. The multimedia instructional approach was utilized for the purpose of (a) improving the quality of classroom instruction through a semi-automated and coordinated system of audio-visual equipment, and (b) providing an instructional environment in which the effects of multiscreen and multimedia techniques on learning could be studied.

Formal instruction was used to acquaint the student with the physical arrangement of the library, the rules, retrieval procedures, and general orientation. Instruction emphasized

the use of the card catalog, including treatment of the more important filing rules, newspaper and periodical indexes, selected references, and an introduction to the more important reference sources. Because of the many visual experiences necessary to effectively present these procedures, the multimedia instructional approach in this study offered a presentation more easily adapted to the classroom. The use of visuals eliminated the necessity of moving many and cumbersome volumes of reference books to the classroom and also kept them available for general circulation among library users. The actual guided tours were also eliminated by the use of pictoral slides, map projectuals, filmstrips, and audio narrations which were simultaneously presented by use of multiscreen and multimedia methods within the classroom.

The program was presented at a pace which the instructor felt to be suitable for the students. The orientation program was designed to be flexible and each presentation was edited by the instructor by removing or replacing slides, transparencies, and other media as questions were posed or review was made.

It is generally accepted that learning is accelerated when concepts, which are being taught, are accompanied by observable and kindred subject matter that is directly related to these concepts. When multimedia techniques, classified as audio, print, and pictorial respectively, are made available for the presentation of information, there are numerous possibilities for their utilization. Through these

media, the instruction, orientation, and motivation of freshmen in library instruction may be accomplished. Through multimedia presentation techniques, equal or superior instruction of the subject matter could be made available to larger groups, thus ideally extending library orientation to all freshmen and new students.

Summary

In view of the changes that are occuring in college enrollment and the increasing importance of library resources in the education of students in schools of higher learning, a reevaluation of current practices of library orientation must take place on the basis of (a) the need for a comprehensive freshman instructional program in the use of the library that extends beyond the usual freshman orientation week, (b) the availability of new media of communication, and (c) increased emphasis upon the individual student.

With the phenomenal growth of printed matter coupled with increasing enrollments, a library orientation program should be concerned with developing a pattern of habits and competencies which will enable the individual student to retrieve information that will verify or extend his knowledge. At all levels of higher education, new knowledge must be made available to students and the academic community. It is not only the responsibility of the library to acquire the most recent material for research and verification, but it must

also provide the student with the skills necessary to locate this material within the library resources.

With concern for the future, this study has been conducted to determine the following: Which one of two approaches: the conventional instructional approach, or the multimedia instructional approach, would be most effective in teaching Library Orientation at Oklahoma State University?

CHAPTER II

REVIEW OF LITERATURE AND THEORETICAL BACKGROUND

This chapter is concerned with the review of selected research related to audio-visual and multimedia systems of instruction. The review will deal with (1) the historical background of the audio-visual movement, (2) research investigations in communication media, and (3) the theoretical background.

Historical Background

The current attention being given to the value of the audio-visual movement as it is utilized in the learning process did not have its inception in the twentieth century. The origin may be traced to the seventeenth century and Johann Andreae who introduced the idea that the utilization of audio-visual materials and methods were the most useful aspects of the educational system. He saw, "the futility of attempting to teach by means of the lecture method alone" and felt that observation, experimentation, and practical application were the keystones in the educational process (18).

The Sense Realists

During this period of time, the sense realists questioned the practices of the educational system and laid the

basis for what is now known as the audio-visual learning concept. This group felt that the proper procedure in teaching was the utilization of things, ideas, and words, and that this was primarily a training in sense-perception through contact with objective material (14). Francis Bacon provided the philosophical basis for this movement when, in his second book, The Advancement of Learning, he ardently sought for a reformation of the organization, content, and methods of higher education of his day. He was opposed to abstractions and sought for a wider course of study and more complete equipment for scientific investigation (25). John Locke pleaded for education through the senses rather than rote memory. He felt that the senses mediate between man and the world; all knowledge finds its origin in the ideals the senses give man, and is conversant about nothing else (11).

Comenius, in his famous Orbus Pictus, lead a group of realists in proclaiming that the senses were the real basis for all learning. In imparting knowledge to children, he felt that the teacher must appeal to them through sense perception as an avenue to knowledge. He shifted the whole emphasis in instruction from words to things (30). Pestalozzi's theory held that sense experiences must be elaborated and organized through observation and the learner must, therefore, acquire a true art of observation of objects (42). Herbart based his theories upon what he termed apperception. He felt that the first presentation made to an individual was not recognized but became a part of the

unconscious mind. The second presentation aroused the former presentation, interacted with it, and the two formed an apperceiving mass which is the human mind. This procedure for instruction was designed to arouse the "many sided interests" of the pupils by using real things and sense impressions (30). Pestalozzi and Herbart were influential in vitalizing the so-called "object teaching" movement which became a historical thread in the evolution of the audio-visual communication movement. Each expressed alternative types of instruction which involved direct and relevant multi-sensory experiences which was a direct reaction against the formalistic and verbal methods of instruction of their day.

The Multi-sensory Movement

Graphic aids, maps, charts, and other forms of multi-sensory media have been used since ancient and medieval times but it has only been since the days of Bacon, Locke, Comenius, and Herbart that the movement became militant in educational circles. From the philosophies of these men, the visual-education movement has emerged.

In the 1860's, new courses began to appear in the curriculum as a result of the Morrill Act which established the Land-Grant Colleges in the United States. The physical and biological sciences, engineering, home economics, and vocational courses began to appear in the college curriculum; chemistry, physics, physical education, and fine arts were taught in the secondary schools to increasingly larger numbers of students. To implement instruction, many multi-sensory

aids were introduced and became potent factors in the improvement of instruction. It was not, however, until before World War I that the movement emerged into the school museum movement, the university extension movement, and the visual-education movement in city-public school systems.

The Audio-visual Movement

Chicago, in 1919, established a Bureau of Visual Education. Other schools provided educational media programs which maintained central respositories of films, lantern slides, and other instructional materials. This group was the nucleus of the visual education movement and existed during the 1918-1928 decade. This movement expanded through the years 1928-1941, but on a limited scale. During this interval, instructional sound film appeared and inspired the 16mm sound-on-film technology in the educational field (4).

Prior to World War II, the armed forces utilized a variety of teaching aids in training military personnel. With the declaration of war in 1941, the accelerated training demands exceeded the instructional staff. To overcome this staff deficiency, a variety of instructional materials were developed. The service training programs employed graphics, models, trainers, slide films, and moving pictures, all of which were found to be effective in all phases of training (40). The impact of the war experiences in the use of these media accelerated this concept in both public schools and industry.

The utilization of educational radio began in 1920 when experimental schools of the air were established, and broadcasting stations were licensed by both private and public educational agencies. The phenomenal growth of radio education occurred during the 1928-1941 period when schools of the air became established, radio research was initiated, and formal courses were offered by institutions of higher learning (46). The major advancement in the field of electronics began in 1952 with the advent of television. Today, there are 109 educational television stations on the air and over 400 closed-circuit television stations are in operation in universities, colleges, and school systems (48). Still another highly significant development was the introduction of electronic sound reproduction and recording installations known as "language laboratories" used in the teaching of foreign languages.

Education has made wide-spread use of the application of technology. Under the sponsorship of the federal government, the United States Office of Education has administered funds for research provided by the National Defense Education Act of 1958. These investigations, along with academic research and studies conducted by the major film and television research programs, have attempted to evaluate the success of the new media approach to education.

Research Investigations in Communication Media

Programmed Learning

Most of the research in the area of programmed learning is recent. These studies have been directed toward two objectives: (1) the development of procedures for analyzing subject matter and converting it into programmed learning sequences, and (2) conducting experimental comparisons between variations in the program. The results of test scores reported in recent studies indicate that students taught by programmed methods do as well as or better than the control group and achieve at this level in less time (28). The use of programmed learning, in addition to other methods of instruction has been shown to produce significant gains within the population evaluated (22). It has been reported that students respond favorably to this method of instruction once they have encountered it (15).

Motion Pictures and Film Techniques

The original motivating theory behind the utilization of the motion picture in the educative process was its superiority. The evidence collected clearly supports the conclusion that with respect to the learning of factual material (1), the findings are favorable to film type teaching techniques. Research has been conducted to ascertain whether motion picture films are as effective instructionally as demonstrations performed during laboratory classes. Senn (49) found that factual material presented by a physics film was done

just as effectively as the traditional laboratory method. Wedberg (58) reported that various visual techniques employed in an introductory education course provided superior instruction to the conventional lecture method.

There is much evidence in favor of the use of films and slides in the teaching of perceptual skills. Studies by Goldstein (23) and Wendt (59) in teaching the rudiments of library science to college students; Chance (7) in teaching descriptive geometry with the use of overhead projector transparencies; Senn (49) in demonstrating physics experiments; and McBeath (38) in teaching science to fourth and fifth grade students demonstrated that instruction by films, filmstrips, slides and overhead transparencies was as effective as or superior to the conventional methods.

Television and Centralized Media

Research in the use of centralized media reports an impressive record. The most traditional centralized technique employed is that of open and/or closed circuit television. This is a field which has undergone intensive research and much of the evidence is favorable to this type of presentation. The history of television research dates back to a study conducted by Coffin (8) and Finn (17) on the social effects of this mode of communication. More recent research has been devoted to the instructional capabilities (31) (32) of educational television and has been found to be effective at all levels of instruction.

The most recent centralized technique being employed is the multimedia instructional laboratory. This integrated audio and visual system is a product of new technological development that provides opportunity for improving the quality of large-group instruction at the university level. This system coordinates the multiple use of film, slide, transparency, tape, lighting, and all other audio-visual media, which progressively augment the progress of the professor's lecture. No recorded research is available at this time on this centralized approach.

The review of literature contained herein is by no means exhaustive and it is not the intention of the writer to imply that all educators have accepted fully the concepts presented by the new media approach to learning. Criticism has taken three forms. Some critics who favor the academic and literary approach believe that the new media in education may hinder the development of reading skills or else dilute subject matter which may abort the development of intellectual skills (2). Others have been concerned with the side effects which may be presented, the power of the machine to effect evil as well as good (57). The greatest criticism, however, is directed toward existing research. These critics feel that there is inadequate evidence to evaluate and interpret research findings and upon which valid conclusions can be based.

Undoubtedly, there may be some validity to the assertions of the critics, yet, there must be a recognition that

technology is now a fact in education. Opportunities to explore and further develop the instructional potentials of the new media techniques are numerous. The threat of technology, according to Bettleheim (3:56),

> . . . is not to deny or neglect the dangers of a situation; not to run away from it by destroying it and depriving oneself of its advantages; but to realize the dangers and meet them with conscious action based upon personal decision. This neutralizes the danger, and lets us enjoy the advantages of technology without letting it deprive us of our humanity.

Theoretical Background

The rise of the multimedia system of instruction has come as a result of the gradual but consistent contributions of technology. The earliest advances to teaching began with the invention of paper followed by movable type. Further technological developments were the invention of photography and lithography which made mass production of educational materials economically available. These advances further stimulated the new techniques of projection through the use of slides and the opaque projector; later sound recording and transmission; the silent motion picture; and finally synchronized motion pictures. The transmission of both sound and motion pictures electronically through the media of television is the latest contribution of technology.

Lumsdane (37) has pointed out that most audio-visual media, like the motion picture and television, were developed with little reference to educational theory. They were used only as stimulus-response devices. Skinner, however,

developed programmed instruction using the new media devices with principles of learning directly related to the active participation of the learner. As the teaching machine and programmed instruction gained acceptance among educators, curricula were prepared which were appropriate to the new media of instruction. As a consequence of Skinner's pioneer work, many experimental psychologists became interested in applying the S-R theory and experimental techniques to practical problems of instruction. Much has been written which pertains to learning theory and programmed instruction.

Learning theory as a basis for more effectively utilizing audio-visual materials has not been explored until recent years. The subject of perception and its bearing upon instruction/learning was discussed in a number of papers and book reviews dating back to 1953 (44). The following year, Gibson's paper "A Theory of Pictoral Perception" was described by A. A. Lumsdaine and S. M. Roshal as "a first attempt to develop a systematic theory of pictoral perception," and "an important contribution both to psychological theory and to the ultimate development of a science of audio-visual instruction." (21:4).

In 1962, Norberg (45) brought together a number of contributions by distinguished authors who prepared articles on the subject, "Perception Theory and AV Education."

The AV Communication Review presented in 1961 a special issue in which each of several well known learning theorists were asked "to indicate his position as to how learning takes

place, and to set forth the implications of this position for instruction and for use of audio-visual materials" (39:4). Meierhenry, the editor, in expressing the need for the application of these general laws of learning to audio-visual education stated:

> The need for careful and systematic theory development seems more necessary now than ever before because newer types of media combine in various ways the older and often simpler experiences. For example, the motion picture combining both an audio and visual message no doubt has a more complex impact on the learner than the spoken word alone, the still picture alone, or the silent "moving picture." Whenever multiple variables are combined, an interaction among them is likely, so the results differ from the results of each variable used singly (39:5).

Meierhenry (39:6) concludes:

> There has been very little speculation in the audio-visual field as to the specific effects of many of the media when used for either general or particular instructional purposes. The reasons for so little careful inquiry and thoughtful effort to obtain better answers are many: among them has certainly been the failure by educators generally, including audio-visual specialists, to be as knowledgable as they should be about the conditions under which learning may be expected to take place.

In an endeavor to gain insight into this neglected area of learning theory and audio-visual utilization, several psychologists contributed articles on this general subject. These include Luchins representing Gestalt psychology; Kendler and his stimulus-response approach; learning and the technology of instruction as expressed by Glaser; and McDonald's view on motivation and the communication process.

Shaw (50) in discussing curriculum and learning theory notes the involvement of the government in federally supported

educational programs and cites in particular the aid-to-education bill passed by Congress in 1965. These expenditures on education constitute a significant part of the nation's gross national product. In an endeavor to utilize these expenditures and justify their cost, a Subcommittee on Economic Progress of the 89th Congress submitted a report on "Automation and Technology in Education." The testimony of this subcommittee indicated that technology and its application to education is in the elementary stages. To rectify this condition, the report comments: "There is great need for more research, not only on the application of technological devices, but also on the learning process itself" (54: 6-7).

The report of the subcommittee states that to utilize the potential contributions of technology, certain factors are necessary requisites. They are:

(1) Effectiveness of research in learning theory and its application to the development of education;

(2) Improvement of curriculum programing, particularly in respect to defining and meeting educational objectives;

(3) Organization of our school systems and intelligent planning of curriculum;

(4) More effective use of teachers; and

(5) Recognition on the part of teachers and educators of the great potential inherent in the new communication technology (54:8).

The government's greatest contribution has been its support of research through the National Defense Education Act under the provisions of Title VII and other more recent

enactments. Since 1962 the U. S. Office of Education has been directly involved in curricular innovations and has produced and disseminated the results to the academic world. The more recent Educational Retrieval Information Centers (ERIC) are expediting the dissemination of recent research.

Drawing upon this literature, an approach to a theoretical model for the transmission of information by audio-visual methods emerges.

Skinner's Verbal Behaviorism

Facts and concepts can be learned through a variety of media, including books and other printed material, lecture presentations, and student discussion. This process involves not only the transmission of a signal from a communicator to a recipient but also some change in the behavior of the recipient is expected as a result of the message. This type of communication results in learning.

Skinner's approach to communication involves a great deal of his theory of behavior. This concept has been summarized in his work Verbal Behavior (52). Hilgard (27) likewise has drawn from Skinner's early works in describing this theory of behavior.

Skinner divides behavior into operant and respondent categories. Respondent behavior includes only those acts that occur under the control of the autonomic nervous system or more commonly termed, the reflexive acts. Operant behavior is that response that occurs as a result of a specific stimuli upon the organism. Skinner contends that the analysis of

the specific stimuli that control the responses are generally unknown, but nonetheless, responses are influenced by two general classes of environmental stimuli which he identifies as reinforcers and discriminative stimuli. The reinforcers are any environmental conditions which strengthens responding by their presence or weaken responding by their absence. He feels that reinforcers may be classified as either primary or secondary. The distinction between primary and secondary is useful to communications, for it suggests that the communicator can either modify behavior by providing the reinforcing stimuli or he can make his own communication reinforcing stimuli by joining it with conditions he wishes to reinforce. Discriminative stimuli, on the other hand, are those environmental conditions which set the occasion for a response to take place. Skinner believes that many of the important discriminative and reinforcing stimuli are external to the organism. Since they are external, these stimuli may be manipulated, and so the behavior they control is brought under the control of the communicator.

Behavior Theory as it is Related to Communication

Skinner, in applying his behavioristic approach to communication embraces the concept that responses are controlled by reinforcing stimuli and discriminative stimuli.

(1) Reinforcing stimuli are defined by Skinner as those stimuli which strengthen behavior by making it more likely or more energetic. He evaluates his reinforcers empirically by

observing which stimuli strengthen responses and which do not. Hartman (26) indicates that this is not a sufficient solution because reinforcers are related to needs and will perform their reinforcing functions only when the proper motivation is present. Stacey (53) has attempted to catalog human motives on both empirical and theoretical grounds. It is felt that once the principal reinforcing stimuli and their underlying motives have been identified, they may be introduced in a communication.

The power to reinforce may, therefore, be acquired by stimuli which did not previously possess this power. The communicator may extend his reinforcers through new-media techniques to the various parts of the environment which he wishes to influence. Teaching at any level must provide some type of stimulation. Learning cannot take place in a sensory vacuum. The instructor must produce stimuli adequate to arrest the attention of the student. Miller (41:76) has portrayed this condition when he said, "the student must notice something." Through the use of technology, instruction can be personalized. The detailed subject of discussion can be visualized to the most distant student in the classroom. The size of the visual image and the amplitude of the sound can be controlled for every student in the learning environment.

A concept, known as the complementary role of audio-visual media in instruction, is out-dating the original supplementary aid concept. The premise of this new role suggests that whenever any task in instruction can be performed by a

technological device, at least as effectively as though a teacher were doing it, then such a task should be assigned to the device (19).

(2) Discriminative stimuli are cue stimuli. They are identified by the fact that they are regularly followed by a specific response or sequence of responses when they are presented. Skinner states that discriminative stimuli control behavior because they have been followed by reinforcement in the past. Reinforcers are utilized in two ways, the first of which is to discover and attempt to take advantage of discriminative stimuli and second, to establish attention to various parts of the environment through reinforcement. Thus, thinking is followed by information seeking, which is followed by more thinking. If the communicator controls the environmental stimuli which are attended to, he controls, to some extent, the course of the chain of thought.

The technological device has an absolute advantage when it is the only means whereby teaching materials may be presented to all members of a group simultaneously. To illustrate: the time lapse of photography in a motion picture is the only way to demonstrate in microscopic detail, the growth of a cell; the details of the paramecium can be visualized to a large group only through projection techniques using a slide; a single library catalog card in library usage can be displayed to the entire group graphically only through audio-visual media. Teaching procedures that give pictoral representation promise to be more effective than procedures relying

upon more abstract symbolism in conveying ideas and relationships (43). Projecting ideas or concepts through film, television, or slides, has an additional absolute advantage in channeling the attention and forming the perceptions of the student in ways not possible through other teaching techniques (33). The multimedia approach utilizes several methods of presentation simultaneously. Through the coordianted and multiple use of technology in the learning environment, the traditional classroom techniques will be supplemented by multiple types of stimuli. These types which are audio, pictoral, and print, enrich and overlap relevant materials giving depth and concentration to the presentation.

Brown and Thorton (5:19) state:

> The new media comprise a diverse group with variant properties, capabilities, and psychological implications. Some are mass media; some are adapted to smaller groups or individuals. Some transmit both visual and auditory stimuli; others are limited to one sensory mode. Some media can transmit live transmissions whereas others are limited to the reproduction of recorded matter. Some can serve as channels for total instructional presentations, as in the case of television and motion pictures; others have more limited or refined capacities which are suited to the selective transmission of special types of stimulus materials within the context of more inclusive instructional presentations.

Fritz (20:16) indicates that:

> Whenever such devices are used, they should be designed to contribute to the kinds of choice and flexibility in a school's environment that characterize optimum conditions for purposeful and significant learning.

Implications for a Theoretical Model

Meierhenry (39:58) has defined communications as:

> . . . any observable behavior by which information is transmitted from an information source to a human recipient. This definition implies that the human object of the communication receives the message in the sense that he is at least aware of it.

In assuming the validity of Meierhenry's definition of communication, learning may be expected to result through the presentation of instructional processes aimed toward the achievement of certain factual objectives.

Learning may then be expedited if attention is given to three areas:

(1) The teacher, or communicator, as the most knowledgable person within the academic setting, should relay the basic message of the course content through whatever modes of media that will transmit cues and stimuli to the student.

(2) In order for learning to result, the learner must receive stimulation which in turn will result in a change within the recipient. As a consequence of the stimuli and the change, either an overt or covert response is made by the learner. This may be represented symbolically by the formula S-O-R, as described by Carpenter (6:297).

where S = stimulus or situation
O = organism or person
R = response or behavior

(3) The instructional procedures must be focused on eliciting stimuli and responses through which the objectives and purposes of the course are achieved.

Thus, when factual information is transmitted by single or multiple communication channels to a recipient, and when

stimuli are elicited until desired responses and behavior result, then learning is the consequence.

The multimedia approach to instruction as presented by this study predicts that learning is increased as the number of available cues or stimuli are increased. By increasing the number of learning channels such as the pictoral (non-verbal), the print (visual verbal), auditory verbal (spoken words), and auditory non-verbal (sound effects and music), additional communication will result from the additional information.

CHAPTER III

RESEARCH DESIGN AND METHODOLOGY

The purpose of this chapter is to present: (1) the general design of the study, (2) a definition of terms, (3) the methodology and design, (4) the measuring devices and testing schedules, (5) the experimental variables, (6) the hypotheses to be tested, (7) the statistical treatment of the data, (8) limitations of the study, and (9) the summary.

The General Design of the Study

In view of the changes that are occuring in college enrollment and the increasing importance of library resources in the education of students in schools of higher learning, this experimental study was conducted in library science education to determine which of two approaches would be most effective in teaching Library Science 111, Library Orientation, at the Oklahoma State University. In conducting this study, the term "experimentation" was defined as:

> The trial of a planned procedure accompanied by control of conditions and/or controlled variation of conditions together with observation of results for the purpose of discovering relationships and evaluating the reasonableness of a given hypothesis (24:215).

In this experiment, the Library Science Orientation was taught using two different approaches: (1) the conventional

instructional approach, and (2) the multimedia instructional approach. In each method, the course content and the concepts were basically the same. The experimental method, according to Good is:

> . . . an experiment in which the variable being studied is the teaching procedure, while an effort is made to hold constant the content presented for learning (24:216).

The same instructor was used in presenting both approaches to the library education classes.

Definition of Terms

In order to avoid misunderstanding, the writer has defined certain terms according to the intended meaning in this study.

Multi-sensory Aids

These aids broadly include the use of textbooks, the lecture, and other verbal materials used in instruction.

Audio-visual Aids

Audio-visual communication is restricted in meaning to special kinds of communication devices and procedures such as motion pictures, filmstrips, radio, television, recordings, tapes, graphic illustrations, models, and demonstrations used to implement instruction.

Multimedia Techniques

This is a system of instruction in which multi-sensory aids and audio-visual aids are coordinated and/or used separately or simultaneously to represent and implement

progressively the progress of a lecture as it is being presented.

Audio-visual Communication

The branch of educational practice concerned primarily with the design and use of messages which control the learning process.

Methodology and Design

Population

The subjects included in this study were selected from the Freshman population enrolled at Oklahoma State University during the fall semester of 1966. The students were assigned to Freshman English sections as they arrived for enrollment. Of the total of these sections, two were randomly selected for the purpose of this experiment. Of the eight sections making up the Library Science 111 groups, four were randomly selected, making a total of six sections used in this study.

Methods and Procedures

During the fall semester, there were approximately 240 students enrolled in the Library Science 111 orientation course at Oklahoma State University. Four groups were randomly selected from the eight sections. Two sections were designated as Experimental Group "E-1", while the remaining two sections were termed Control Group "C-1". By standards established for the study, the students evaluated were to be freshmen. The actual sections, however, had a heterogeneous

population of sophomores, juniors, and seniors as well as freshmen. When all but the freshmen were eliminated, there was an "N" of 26 in the Experimental Group "E-1" and an "N" of 31 in the Control Group "C-1".

Two sections were randomly selected from 96 sections of Freshman English. The population within these sections were characteristically freshmen and ranged in size from 25 to 35 students each. In reducing the population size to be comparable with the other two groups, a table of random numbers was employed to bring the total "N" to 27. These students were designated Control Group "C-2" throughout the study.

A description of the individual groups and the planned teaching procedures are as follows:

Control Group "C-1". This group was the control group within the Library Science Education Department. They studied the subject matter using the conventional approach. Classes met for one hour a week for a period of sixteen weeks. Students received lecture-type instruction utilizing multi-sensory aids. The instruction was supplemented with tours of the library areas for orientation.

Experimental Group "E-1". This group was the experimental group for the study. They were instructed using the multimedia instructional approach. They met for sixteen weeks for one hour each week. The instruction utilized a variety of audiovisual media and experiences which were integrated with other instructional material. These materials overlapped and reinforced the value of the other; some media were used to motivate interest, while others were used to communicate basic facts. The objectives and material covered were identical with those of Control Group "C-1". The experimental group was instructed within the confines of the classroom.

Control Group "C-2". This group is the control group for the study. They received no formal instruction or orientation which was related to the library. Their use and investigation of the library was

motivated only by the demands placed upon them by their academic pursuits.

The Measuring Devices and Testing Schedules

The Testing Instruments

In this study, three different measuring devices were used. They are as follows:

(1) The American College Test. This is a test which is being administered throughout the United States. In Oklahoma, it is being required for entrance into the state-supported institutions for higher learning. It is a test sequence which covers four areas: English, Social Studies, Natural Science, and Mathematics. There is also a composite score based on overall test results.

(2) The Bennett Use of Library Test. This is a standardized achievement test in two forms which measures the knowledge of college students in library organization and practice. It is a test sequence for covering several broad areas: the book, the catalog, the reference tools, indexes, and Dewey Decimal Classification.

(3) The Library Time-Retrieval Test. This instrument was developed by the writer to test the actual ability of the population of the study in retrieving factual information contained within the resources of the Oklahoma State University Library. The instrument (see Appendix B) was validated using the procedures outlined in Appendix A. The pilot groups for the purpose of testing the instrument were Library Science 111 students who were of similar academic standing to the experimental group.

Testing Schedule

The purpose of the testing program was to measure growth on the part of the student with regard to his achievement in library skills and his ability in library search procedures.

By the nature of the course content and the criteria on which this study is based, the following testing schedule was maintained.

The results of the American College Test (ACT), which was administered to incoming Freshmen, were the control variables used to assist in establishing the homogeneity of the groups at the beginning of the study.

During the first class session, the students in the three groups were given a pre-test, the Bennett Use of Library Test, Form A.

The final testing sequence included a post-test, the Bennett Use of Library Test, Form B, which was administered during the fourteenth week of the semester to determine the dependent variables or gain scores of the subjects.

During the fifteenth week, the Library Time-Retrieval Test was administered, acting as another dependent variable on student achievement in search procedures.

The Experimental Variables

Independent Variables

The independent variables were the teaching methods used, the conventional approach and the multimedia approach.

Dependent Variables

The dependent variables were the scores obtained on the various tests which were administered to the students participating in the study at the end of the instructional period.

Concomitant Variables

The concomitant variables were the pre-test scores of the Bennett Use of Library Test, and the scores derived from the American College Test (ACT).

Hypotheses to be Tested

This study was directed to determine whether understandings of library procedures and orientation offered by a library science course at Oklahoma State University could be attained as well through multimedia presentation techniques as through the traditional orientation procedures.

The principal hypotheses to be tested in this study are:

Hypothesis H_1 There will be no significant differences in the mean scores of the three groups at the end of the experiment with regard to library knowledge at the five per cent level of significance.

Hypothesis H_2 There will be no significant differences in the mean scores of the three groups at the end of the experiment with regard to library retrieval ability at the five per cent level of significance.

Hypothesis H_3 There will be no significant differences in the mean scores of the three groups at the end of the experiment with regard to time-lapse-span in library material retrieval at the five per cent level of significance.

Statistical Treatment of the Data

The analysis of covariance was used in testing Hypothesis H_1 pertaining to the differences in academic achievement, with the differences in ability determined by pre and post test results. In Hypothesis H_2 the Kruskal-Wallis Test for the analysis of variance was utilized to determine if significant differences existed in library retrieval ability. Hypothesis H_3 concerning time-lapse-span in library retrieval was tested using the analysis of variance statistical model.

In the computations for each hypothesis, the test of significance for the differences between the three groups were tested simultaneously.

To further test the data where significant differences occurred, the Scheffe' Test was used on Hypothesis H_1 and Hypothesis H_3. In evaluating the combination of any two of the three independent groups in Hypothesis H_2, the Mann-Whitney U Test was used.

Limitations of the Study

Several limiting factors are apparent in this study. The total number of students involved was limited. When one considers the large number of students enrolled in the Freshman class in a given academic year, 100 students seem to be a very small sample. Generally, the power of a statistical test increases with an increase in the size of the sample.

Variable class size might be considered a limitation of the study. However, the statistical analysis should take care of this matter of unequal sample size. In reference to sections with different numbers of subjects, Siegel (51:95) remarks:

> In this design two samples may be obtained by either of two methods: (a) they may each be drawn at random from two populations, or (b) they may arise from the assignment at random of two treatments to the members of some sample whose origins are arbitrary. In either case, it is not necessary that the two samples be the same size.

Other limitations exist within this study. It must be assumed that variations exist in the students from section to

section within the various colleges of the university. The only comparison made was from the results of the American College Test scores. No attempt was made to ascertain the motivation of the individual students, their secondary school library backgrounds, or the influence of their geographic culture. The writer assumed that the effect of these factors were minimized by random assignment of subjects and procedures.

Summary

This was an experimental study in library science education. The sample for this experiment was freshman students from Oklahoma State University. They were randomly assigned to sections and six sections were randomly selected for the purpose of this study.

During the fall semester of 1966, the students were instructed in library orientation. One group received instruction in the conventional lecture method while the experimental group was instructed with multimedia techniques. A third and control group received no formal orientation. At the beginning they were tested to measure ability in library knowledge and techniques. At the end of the experiment, they were again tested in the same areas along with retrieval procedures utilizing the skills they had learned during the course of instruction.

The analysis of covariance statistical test was used to determine whether or not any significant differences existed

between the three groups with regard to mean scores at the five per cent level of significance in connection with library knowledge. The analysis of variance statistical model was used to test the time-lapse-span factor in retrieval time. The Kruskal-Wallis Test was used to determine significant differences in retrieval ability.

Three hypotheses were tested. The first hypothesis related itself to library knowledge, the second to library retrieval ability and the third to the time-lapse-span in library material retrieval.

CHAPTER IV

STATISTICAL TREATMENT OF THE DATA

This study was conducted to answer the following question: Which one of two approaches (1) the conventional instructional approach, or (2) the multimedia instructional approach, would be more effective in teaching the Freshman Library Orientation course at Oklahoma State University? Both of these methods were defined and discussed in Chapter III.

The Bennett Use of Library Test was administered for the purpose of evaluating the student's performance concerning library knowledge and practices. The Library Time-Retrieval Test was used to measure two factors: (1) the actual ability of the students in retrieving factual material contained within the library, and (2) the time-lapse-span required in retrieving this information. In addition, the composite scores of the American College Test (ACT), computed on the basis of the raw scores of the sub-tests in mathematics, social studies, English, and natural science, were used in testing the first hypothesis.

This chapter will present the findings of the study to determine if significant differences appear among the experimental group and the two control groups. The five per

cent level of confidence was used to determine significance on the hypotheses under consideration.

Testing of the Hypotheses

In selecting appropriate statistical tests for the analysis of the data derived from this study, certain assumptions were made. The parametric statistics which were employed assumed that the samples were from a single normally distributed population. The variances were assumed to be homogeneous among the three groups. Finally, the observations were assumed to be independent.

Hypothesis H_1

There are no significant differences in the mean scores among experimental group one, control group one, and control group two with respect to the scores attained on a test for library knowledge.

The analysis of covariance technique was used although homogeneous variances were postulated for testing the first hypothesis with the Bennett Use of Library pretest and American College Test scores planned for in the experiment and available for analysis. Table I shows the data as related to the analysis of covariance. It gives the computed F value, the degrees of freedom, and adjusted sum of squares.

The F test yielded:

$$F = \frac{408.07}{52.98} = 7.7 > 3.11 = F_{.05\ 2,79}$$

An F test of 7.7 is sufficient evidence to reject the hypothesis, and it was concluded that a significant difference occurred among the experimental, traditional, and control groups.

TABLE I

ANALYSIS OF COVARIANCE: LIBRARY KNOWLEDGE AMONG EXPERIMENTAL GROUP AND CONTROL GROUPS

Source of Variation	df	Adjusted Sum of Squares	Variance Estimate
Total	81	5001.33	
Between	2	816.14	408.07
Within	79	4185.18	52.98

$F_{2,79} = 7.7 > 3.11 = F_{.05\ 2,79}$

To test the data further, the Scheffé analysis was conducted. "Following the application of an F test, a meaningful interpretation of the data may require a comparison of pairs of means" (16:295). Since there was a significant F ratio in the analysis of covariance, inferences about the contrasts among the adjusted means of the experimental, traditional, and control groups were analyzed.

Utilizing the data found in Table I, the within-group mean variance of 52.98 with 79 degrees of freedom and the adjusted mean scores for the three groups recorded in Table II were used. The values of F obtained using the Scheffé formula (16:296) (47) are indicated in Table III.

TABLE II

ADJUSTED MEANS AND STANDARD ERRORS
LIBRARY KNOWLEDGE

Group	Unadjusted Means	Adjusted Means	S.E. Adjusted Means
Experimental	90.54	91.23	1.44
Traditional	89.55	89.49	1.31
Control	84.29	83.69	1.41
Unadjusted mean for all subjects (common mean):		88.13	

TABLE III

THE F VALUES DERIVED FROM THE SCHEFFE' TEST
ON LIBRARY KNOWLEDGE GROUPS

Comparison of Groups	F Value
Experimental-Control	14.24
Experimental-Traditional	.81
Traditional-Control	9.14

$F_{.05}\ 1,79 = 3.96$

$F' = k - 1\ (F) = 7.92$

For any difference between groups taken two at a time to be significant at the .05 level, F must be equal to or greater than F'.

The value of F' required for significance at the .05 level (16) for 1 df and 79 df is 7.92. The values were 14.24 for the experimental and control group and 9.14 for the traditional and control group. No significant difference occurred between the experimental and traditional groups when library knowledge variables were "adjusted for" statistically using the analysis of covariance and the Scheffe' tests. There was, however, significant differences between both experimental and traditional groups as compared with the control group.

Hypothesis H_2

There are no significant differences in the mean scores among experimental group one, control group one, and control group two with respect to the scores attained on a test of library retrieval ability.

The Bartlett Test for homogeneity (35) (60) was run on the scores derived from the Library Time-Retrieval Test and the groups were found to be heterogeneous as indicated in Appendix D. Since the sample was not within the bounds of random variation, the Kruskal-Wallis test for analysis of variance was used. This test ". . . assumes that the variable under study has an underlying continuous distribution. It requires at least ordinal measurement of that variable" (51:185).

The scores derived from the test were ranked in a single series. Table IV indicates the three groups, experimental, traditional, and control; the number of observations;

and the average rank. With these data, the value of $\underline{H}$ was computed to be 33.44. The table of critical values of chi-square indicates that at 2 degrees of freedom, this value is 5.99. The computed value was 33.44, indicating a high degree of difference among the three groups.

TABLE IV

LIBRARY RETRIEVAL ABILITY: RANK OF SCORES OF EXPERIMENTAL GROUP AND CONTROL GROUPS

Group	Number of Observations	Average Rank
Experimental	26	58.98
Traditional	31	47.03
Control	27	21.43

$\underline{H} = 33.44$

$2df_{.05} = 5.99 < 33.44$

In testing these data to determine where the significant differences fell, the Mann-Whitney U Test was used to evaluate the combinations of any two of the three independent groups. Table V shows the three groups along with the $\underline{z}$ values for each.

In making a meaningful interpretation of the data in Hypotheses H_1 and H_3, where the Scheffe'Test was employed, a comparison of pairs of means was made. When the Scheffe' technique is applied to any combination of pairs, it becomes

a more discriminative tool where $F' = k - 1 (F)$, as shown in Table III. In maintaining consistency in interpreting the results of the tests where comparisons of pairs was made, it was felt that the results of the Mann-Whitney U Test should be interpreted at the 2.5 per cent level of significance.

TABLE V

LIBRARY RETRIEVAL ABILITY AND THE z VALUES DERIVED FROM THE MANN-WHITNEY TEST

Comparison of Groups	z Values
Experimental-Control	-5.48
Experimental-Traditional	-1.97
Traditional-Control	-4.11
$z = \pm 2.32 \infty df$	

The Mann-Whitney approximation to the z for experimental and control comparisons gave a value of -5.48. The critical value for the z test with infinite degrees of freedom is ±2.32. Therefore, the experimental and control groups indicate a highly significant difference. The experimental and traditional combination had a value of $-1.97 < \pm 2.32$, indicating no significant difference. Evaluating the traditional and control groups, the z value was $-4.11 > \pm 2.32$, indicating a highly significant difference, the degree of difference, however, not being as great as the experimental and control groups.

Table IV gives the H value as highly significant. Therefore, Hypothesis H_2 was rejected, and the conclusion was established that there was a highly significant difference in retrieval ability. Table V indicates the obtained z values among the three groups. No significant differences occurred between the experimental and traditional groups. There were, however, significant differences between both experimental and traditional groups as compared with the control group.

Hypothesis H_3

There are no significant differences in the mean scores among experimental group one, control group one, and control group two with respect to the scores attained on a test involving the time-lapse-span in library retrieval.

Bartlett's Test for homogeneity of variance (35) (60) was run on the test sequence and no significant differences were found at the five per cent level of significance as indicated in Appendix D. In assuming the data were a random sample of the population and distributed normally, the statistical analysis used was the analysis of variance.

Data from Table VI show the computed F value, the degrees of freedom, and mean squares while Table VII gives the mean scores of the three groups.

The results for the analysis of variance are shown in Table VI. As indicated in the table, the obtained F value was 13.96 with the required value for significance at 3.11. On the basis of these values, it was concluded that there was

a highly significant difference among the three groups regarding time-lapse-span in retrieval procedures.

TABLE VI

ANALYSIS OF VARIANCE OF TIME-LAPSE-SPAN SCORES AMONG THE EXPERIMENTAL GROUP AND CONTROL GROUPS

Source of Variation	df	Sum of Squares	Mean Squares
Total	83	4418.71	
Between	2	1132.58	566.29
Within	81	3286.13	40.57

$F_{2,81} = 13.96 > 3.11 = F_{.05\ 2,81}$

TABLE VII

LIBRARY RETRIEVAL TIME-LAPSE-SPAN MEAN SCORES

Group	Number	Mean Scores
Experimental	26	33.8
Traditional	31	40.2
Control	27	42.7

In making a meaningful comparison of pairs of means, the Scheffe' test was conducted. Using the within-group variance of 40.57 with 81 degrees of freedom found in Table VI and

the mean scores for the three groups listed in Table VII, the comparisons of the groups were made.

The results of the Scheffe' comparisons may be found in Table VIII. Using 1 and 81 degrees of freedom at the .05 level, 7.92 is the F'value required for significance. The computed value of 25.3 for the experimental and control groups and 14.32 for the experimental and traditional groups indicate a highly significant difference among these combinations. The value found between the traditional and control groups of 2.22 indicates no significant difference.

TABLE VIII

THE F VALUES DERIVED FROM THE SCHEFFE' TEST ON TIME-LAPSE-SPAN IN LIBRARY RETRIEVAL BY GROUPS

Comparison of Groups	F Values
Experimental-Control	25.3
Experimental-Traditional	14.32
Traditional-Control	2.22

$$F_{.05}\ 1,81 = 3.96$$

$$F' = k - 1\ (F) = 7.92$$

For any difference between groups taken two at a time to be significant at the .05 level, F must be equal to or greater than F'.

On the basis of these computations, the hypothesis that no significant differences exist among the three groups was

rejected. Further evaluation indicated that the experimental group shows a highly significant difference from the traditional and control groups.

Summary

The purpose of this study was to investigate which of two instructional approaches would be more effective in teaching Freshman Library Orientation. The approaches were: (1) the conventional instructional approach, and (2) the multimedia instructional approach.

The population for this study was comprised of three groups of freshmen. They were: (1) experimental group one, the experimental sections, (2) control group one, the traditional sections, and (3) control group two, the controlled English sections receiving no formal instruction in library usage.

The evaluative criteria used in making judgments were: (1) library knowledge and practices, (2) library retrieval ability, and (3) the time-lapse-span involved in the retrieval procedure. Tests were given at the beginning and end of the experimental period to measure these factors. Both parametric and nonparametric statistical treatments were applied to the data derived from the tests. The F test and Kruskal-Wallis H test were used to determine whether significant differences existed among the three groups. Significant differences were evident in each of the three areas being evaluated.

The hypothesis of no significant difference among the three groups with regard to library knowledge was rejected. A significant F value existed between the experimental and control, and the traditional and control groups. No significant differences existed between the experimental and traditional groups.

The hypothesis of no significant difference among the three groups in regard to library retrieval ability was rejected. A highly significant z value approximation for the Mann-Whitney U Test existed between the experimental and control as well as the traditional and control groups. There was no significant difference between the experimental and traditional sections.

The hypothesis of no significant difference among the three groups with regard to time-lapse-span in retrieval ability was rejected. A highly significant difference was evident between the experimental and control groups and the experimental and traditional groups. No significant difference existed between the traditional and control groups.

CHAPTER V

SUMMARY, LIMITATIONS, CONCLUSIONS, AND RECOMMENDATIONS

It is the intent of this chapter to first, summarize the investigation; second, discuss some limitations of the study; third, make conclusions based upon the statistical analysis; and fourth, to suggest recommendations for further study.

Summary

Recent publications have shown the interest of library administrators in methods of library orientation and their subsequent effect upon student utilization of the library resources. With expanding freshman enrollments, the increasing number of transfer students from smaller colleges, and advanced research students entering the university at the graduate level, the task of orienting these students to a research library is becoming prohibitive in cost and time. Teachers in this academic field are also constantly challenged with the problem of selecting an appropriate and effective instructional method or combination of methods (59). They are, likewise, continually challenged concerning program evaluation and the need for wise and efficient planning to maximize productivity and effectiveness in future programs.

The multimedia instructional technique, a new but carefully coordinated audio-visual approach to instruction, has recently received wide publicity and offers hope for a superior and more economical teaching method in library science because of its adaptability to larger sections of students.

In this study, an empirical analysis was made of the multimedia instructional technique as it was applied to the orientation of freshmen in library procedures. Total performance effectiveness was measured by gains in knowledge as measured by the dependent variables. The concomitant variables were the pretest scores of a standardized library instrument and the scores derived from the American College Test. The teaching methods used were the independent variables referred to as the traditional approach and the experimental approach which used the multimedia technique. A control group was selected from the freshman English sections. The study extended throughout a seventeen week period. The data derived were statistically analyzed for significance using the analysis of covariance, the Kruskal-Wallis analysis of variance, and the analysis of variance statistical model for comparison among means. The Scheffe'test and the Mann-Whitney tests were used for tests of two groups at a time to determine the area of significant differences where the hypotheses were rejected.

Limitations

The conclusions drawn from the data presented in this study have value only as certain limitations are realistically recognized.

First, generalizations that would relate the findings of this study to other libraries can be undertaken only with caution. The instrument used in the measurement of the library retrieval variable would be applicable only to the library in which the instrument was validated. The preparation of the audio-visual media were specifically programmed for use in the Oklahoma State University Library. However, principles employed in both the testing instrument and the multimedia techniques could be applicable to any library orientation or academic discipline through proper modifications.

Second, the sample may be questioned as not representative beyond the immediate college population.

A third limitation is the writer's concern that there were other potential intervening variables that had influence upon the subjects as the study progressed. The "Hawthorne effect" may have been operative in the experimental groups because of the nature of the physical arrangement and the visual aids present in the classroom laboratory.

Conclusions

The findings of this study rejected the hypotheses under consideration as follows:

1. Library orientation taught through the traditional instructional approach and the multimedia approach showed statistically significant increase in knowledge related to library skills and procedures. When compared together, the two orientation methods evaluated on pretest and posttest measurement showed no differences. When each instructional method was compared to the control group, however, a highly significant difference existed.
2. In evaluating the two instructional approaches and the control sections, a highly significant difference was indicated in retrieval ability. When the three groups were compared by pairs, the two orientation methods showed no significant difference in retrieval ability. When the experimental group as well as the traditional group were compared to the control group, a highly significant difference was evident.
3. The time factor involved in finding library material was evaluated in hypothesis three. When the data were analyzed, a significant difference existed among the three groups. When evaluated by combinations of pairs, the experimental section indicated a highly significant difference to both the traditional instructional approach and the control group. No significant difference in time-lapse-span existed between the traditional and control groups.

Recommendations

Much experience was gained in this initial library orientation multimedia instructional program. As the study progressed, several areas were apparent in which certain refinements in the methods and techniques employed would improve a future orientation program and the research involved.

1. The writer found himself apprehensive of the small population of freshmen in the library science groups. In attempting a similar study with a similar population, additional sections should be included to increase the total number of the freshman population.
2. The multimedia facilities were often inadequate to maximize the full value of the multi-channel instructional approach. In further research, the writer recommends a classroom or auditorium with accompanying and appropriate equipment in which the instructor may utilize and coordinate the use of visual aids more effectively.
3. It was the intent of this study to present a method of instruction that could be effectively presented to larger sections of students, yet, giving them a "personalized orientation." The writer was generally satisfied with the results of the experimental method of orientation. He recommends a similar study with sections numbering several times the size of the groups used in this study. This could

be undertaken only when adequate multimedia laboratories are available.

4. The Bennett Use of Library Test is the only standardized test in this subject area. The writer is of the opinion that this instrument should be revised.

The findings of this study will have value proportional to their use and application in similar and related fields. They suggest that more projects on a considerably larger scale should be undertaken.

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APPENDIX A

VALIDATING PROCEDURES FOR THE LIBRARY TIME-RETRIEVAL TEST

LIBRARY TIME-RETRIEVAL TEST

In a testing situation, it is essential to measure progress in learning to determine the extent that important objectives have been reached. The course of study and the method of presentation as posed by this study have certain objectives which extend beyond the mere memorization of facts. They extend into the application of skills or knowledge and the utilization of the many ideas presented in the course of study.

The examining procedure for this study necessitated the construction of an instrument that would measure the achievement of the population. The standardized test in two forms was adequate to appraise factual learning. However, an adequate instrument was not available which would evaluate student success in utilizing factual material and making application of the knowledge learned.

The Purpose and Selection of Test Items

The instrument validated for use in this study was designed to test the actual ability of the experimental and control groups in retrieving factual information contained in the resources of Oklahoma State University Library. To assure the success of this search, knowledge of certain basic library skills would be essential. The objectives of the course of study were designed to present the academic principles of library usage along with competency in utilizing these skills in actual search procedures.

Item Selection Techniques

A questionnaire was submitted to nineteen professional librarians of the Oklahoma State University Library who were familiar with the needs of university undergraduates and their research problems. They were asked to list ten library tools and/or techniques which they felt were necessary for college freshmen to have mastered by the end of their first semester at Oklahoma State University.

Test Items Selected by the Professional Staff

Thirteen professional librarians responded to the questionnaire. Their areas of responsibility included the physical sciences, the biological sciences, documents, humanities, social sciences, reference, and library education. These departments represented responses from most of the major academic areas of the library. Their evaluations were not stereotyped. A definite pattern emerged as their responses were categorized into the following five areas: (1) the card catalog, (2) the index tools, (3) library orientation, (4) retrieval procedures, and (5) reference tools.

Test Validation Procedures

Preliminary trial instruments were constructed and administered to librarians, graduate students, and undergraduate classes in library education. From this initial effort, a fifty-eight item instrument was drafted which

contained questions encompassing exercises in the practical use of index tools, reference books, the card catalog, retrieval procedures, and library orientation.

This instrument was administered to seven sections of Library Science 111 orientation students at the close of the semester. It was felt that the competency of these students in library usage would be commensurate to those of the research groups as they terminated their experimental program.

Item Analysis

The results of the validating test which was administered to the Library Science Education sections were utilized to determine the difficulty level of each of the fifty-eight test items. The extent to which each item discriminates between the students in the groups evaluated was also considered. The split-half method was used in the item analysis in which the test and item results of those students who obtained high scores were evaluated against those who obtained low scores on the entire set of items.

The Difficulty Index

Several factors must be considered when an item is selected for a test. Such a factor is the difficulty of each item. Maximum reliability and dispersion of scores is attained when an item has approximately 50 per cent difficulty. This is determined by adding the total number of students answering the item correctly and falling in the upper half of the score dispersion and the total number of

students in the lower half who answer the item correctly. The total of these two scores is then divided by the total number of students attempting the item.

$$\frac{H + L}{N} = \text{Difficulty}$$

The range of boundaries considered to be acceptable are approximately 35 - 80 (12). Of the fifty-eight items, thirty-three met the difficulty criterion just described.

The Discrimination Index

Discrimination is the power of a test item to differentiate among poor, average, and good individuals in achievement, interest, or other evaluative characteristics. A single test item is regarded as having perfect positive discriminating power if everyone in the high-scoring group and no one in the low-scoring group answers it correctly.

The thirty-three items which were within the range boundaries of the difficulty index were used in the evaluative process to determine the discriminative power. Davis (12) has demonstrated that more "highs" than "lows" should exceed ten per cent of the total number of students taking the test. The larger the percentage, the more the discriminative power. Using this method, twenty-five test items were found to have adequate discrimination.

Test Reliability

The reliability for the retrieval instrument was derived from the data by means of the Kuder-Richardson formula 21

(10) (34). The test items which did not meet the difficulty and discrimination criterions were eliminated and the test was scored on the basis of the remaining items, of which there were twenty-five.

The equation for the Kuder Richardson formula 21 gives the estimate of the reliability of a test. The data required are: N = the number of items in the test; SD = the standard deviation; and M = the mean of the total scores.

Equations used in deriving the r on reliability follow.

(1) Standard deviation.

$$SD = \frac{\Sigma \text{High } 1/6 - \Sigma \text{Low } 1/6}{\frac{1}{2} \text{ Number of Students}}$$

$$SD = 6.66$$

(2) Mean.

$$M = \frac{\Sigma X}{N}$$

$$M = 12.24$$

(3) Kuder-Richardson formula 21.

$$r = \frac{N(SD)^2 - M(N-M)}{N(SD)^2}$$

$$r = .86$$

The instrument as used in the evaluative process of this study is contained in APPENDIX B: DATA COLLECTION INSTRUMENT.

APPENDIX B

DATA COLLECTION INSTRUMENT

LIBRARY TIME-RETRIEVAL TEST

Listed below are twenty-five questions which are designed to test your ability in retrieving information contained within the library. You are to work independently. You have access to all of the facilities of the library and may use any reference tool or library aid as assistance in finding the answers.

Print your name below and note the exact time you begin. Record the exact time again when you complete the test.

NAME_____
Beginning Time_____ Finishing Time_____

1. Smith, Herbert A. wrote a book, The Law and Custom of the Sea. What is the call number of this book?_____
2. If you wish to take a book from the library when the subject areas are not staffed, how do you check it out?
_____
3. You wish to consult Facts on File for the year 1961. Which floor of the library will you expect to find this reference tool?_____ Floor.
4. Below is listed an entry from a periodical index:
   Culligan, Matthew Joseph. More Changes at Curtis.
   por Time 80:52 J1 6'62.
   What does the term "por" mean?_____
5. Where may Chemical Abstracts be found?_____
6. Name the publisher of Earl McGrath's book, Education, the Wellspring of Democracy. _____
7. Upon which floor of the library are the General Reserve Books kept?_____ Floor.
8. During what years was Leopold I the King of Belgium?
_____ to _____.
9. The following citation is taken from the Public Affairs Information Bulletin:
   The story of Tata Steel (works). il March of India 11: 36-41 Mr. '59.
   What does "il" in this citation mean?_____
10. A complete listing of periodicals in the library can be found on _____ floor.
11. Alan Edward Nourse had a book copyrighted in 1960. What is the call number for this book?_____
12. The symbol "R" above a call number indicates the book will be found on _____ floor.
13. In which volume of the Encyclopedia Americana would you find the article "Porteous Riot?" Vol._____
14. The following entry is from the International Index:
   Ewing, E. W. Orr. Lost World Revisited.
   Blackw 294:67-71 J1 '63.
   What is the call number of the periodical in this entry?_____

15. Where in the library would you find the most recent issue of the magazine Film Quarterly?_____ floor.
16. Under normal conditions, books may be checked out for a period of _____ days.
17. Under the heading NATCHEZ, MISSISSIPPI--HISTORY, Harne Kane wrote a book which was copyrighted in 1947. How many pages are contained in this book? _____ pages.
18. You are in need of a list of the diplomatic representatives to the country of Nigeria. What reference book would give you this information?_____
19. Upon which floor of the library is the Monthly Catalog of U.S. Government Publications?_____ floor.
20. Give the Range number (shelf) upon which the following book may be found. Guadalcanal Diary.
    Range number_____.
21. William Faulkner's book Sartoris has the following call number. 813 F263sa. What is the name of the publisher?
    _____.
22. Upon which two floors of the library are Xerox copying services available to the library user? _____
    and _____.
23. Below is an entry taken from the Book Review Digest:
    +Ny Times p 22 My 27 '45 230w.
    What does the 230w mean?_____
24. In which periodical index can a Life magazine article be located?_____
25. The U.S. National Bureau of Standards Journal has been given the following classification number.
    ECP279
    J86
    What floor of the library would have this journal?
    _____ floor.

PLEASE NOTE YOUR FINISHING TIME ABOVE !

APPENDIX C

INDIVIDUAL SCORES OF SUBJECTS PARTICIPATING IN THE STUDY

CONTROL SECTIONS

	BENNETT USE OF LIBRARY TEST		AMERICAN COLLEGE TEST	LIBRARY TIME-RETRIEVAL TEST	
PUPIL	POST	PRE	ACT	RETRIEVAL	TIME
1	93	96	19	18	37
2	65	91	18	20	46
3	74	91	23	14	46
4	83	88	25	17	36
5	94	95	24	14	41
6	87	89	23	11	26
7	91	89	20	14	46
8	79	76	19	6	44
9	98	84	27	14	52
10	73	81	20	13	45
11	73	84	15	6	47
12	80	82	19	14	41
13	100	97	27	9	43
14	96	102	24	20	45
15	100	101	24	15	44
16	82	85	22	14	41
17	81	85	16	13	45
18	83	78	20	18	37
19	83	91	21	20	39
20	87	96	18	12	47
21	91	97	21	16	42
22	70	76	18	13	42
23	92	93	20	18	45
24	74	94	23	16	46
25	86	83	22	16	47
26	81	83	18	13	40
27	80	82	18	19	45

EXPERIMENTAL SECTIONS

	BENNETT USE OF LIBRARY TEST		AMERICAN COLLEGE TEST	LIBRARY TIME-RETRIEVAL TEST	
PUPIL	POST	PRE	ACT	RETRIEVAL	TIME
1	93	87	15	23	22
2	91	90	23	17	31
3	88	75	18	23	27
4	94	85	22	21	38
5	90	88	22	23	40
6	77	76	23	20	41
7	105	91	21	23	42
8	98	90	21	18	38
9	79	88	24	20	36
10	88	90	21	20	44
11	96	81	25	21	21
12	100	83	24	22	41
13	99	98	22	22	22
14	87	77	22	18	35
15	87	88	22	23	28
16	89	93	24	22	43
17	96	97	26	22	35
18	95	85	18	20	30
19	71	76	11	18	35
20	95	79	18	18	30
21	92	89	18	18	32
22	88	84	25	21	27
23	73	74	09	22	36
24	84	84	19	19	38
25	97	88	25	22	37
26	102	99	24	22	30

TRADITIONAL SECTIONS

	BENNETT USE OF LIBRARY TEST		AMERICAN COLLEGE TEST	LIBRARY TIME-RETRIEVAL TEST	
PUPIL	POST	PRE	ACT	RETRIEVAL	TIME
1	97	87	23	19	46
2	98	91	27	21	32
3	67	69	13	21	35
4	79	85	25	24	36
5	97	87	22	19	37
6	87	88	19	23	34
7	102	76	27	23	47
8	86	87	20	14	46
9	103	98	25	23	28
10	92	84	21	19	45
11	92	94	24	24	39
12	73	77	14	11	46
13	82	85	19	21	32
14	85	83	19	16	47
15	87	88	24	18	47
16	97	99	24	17	47
17	88	83	11	20	46
18	88	92	20	20	30
19	90	97	13	14	27
20	87	77	19	16	34
21	86	92	22	23	44
22	82	91	22	18	45
23	70	73	19	14	35
24	93	86	24	17	47
25	106	101	24	20	27
26	88	84	09	18	44
27	87	87	19	18	51
28	98	87	28	23	44
29	94	93	25	16	48
30	95	82	22	18	44
31	100	88	22	20	37

APPENDIX D

TESTS FOR HOMOGENEITY

APPENDIX D

THE CHI-SQUARE VALUES DERIVED FROM THE BARTLETT TEST FOR HOMOGENEITY

Test	df	Corrected Chi-Square
Retrieval Test	2	10.48
Time-Lapse-Span Test	2	3.84

$$\chi^2_{.05}\ 2\ df = 5.99$$

Test for Homogeneity, Hypothesis H_a

The Bartlett Test for homogeneity was run on the Library Time-Retrieval Test in regard to the scores attained for retrieval ability. The χ^2 test yielded:

$$\chi^2_{.05}\ 2\ df = 5.99 < 10.48$$

The computed score of 10.48 indicates sufficient evidence to reject the null hypothesis. On this basis, the three groups are not homogeneous at the 5 per cent level of significance and a nonparametric instrument must be employed to test the hypothesis for significant differences.

Test for Homogeneity, Hypothesis H_3

The Bartlett Test for homogeneity was run on the Library Time-Retrieval Test regarding the time-lapse-span in retrieval ability. The χ^2 test yielded:

$$\chi^2_{.05}\ 2\ df = 5.99 > 3.84$$

The computed score of 3.84 indicates insufficient evidence to reject the null hypothesis of no significant differences in the three groups. Therefore, the three groups are homogeneous at the 5 per cent level of significance. A parametric test may be utilized to test the hypothesis for significant differences.

VITA

Earl Eugene Wassom

Candidate for the Degree of

Doctor of Education

Thesis: A STUDY OF THE EFFECTS OF MULTIMEDIA INSTRUCTIONAL TECHNIQUES ON A COLLEGE FRESHMAN LIBRARY ORIENTATION PROGRAM

Major Field: Higher Education

Biographical:

Personal Data: Born in Blackwell, Oklahoma, September 20, 1923, the son of Grover Cleveland and Eva Stone Wassom. He married the former Cynthia Elizabeth Johnson in 1946. His family include two children, Reginald 12 years of age, and Karen 9 years of age.

Education: Attended grade school in Blackwell, Tonkawa and Ponca City, Oklahoma; graduated from Ponca City, High School, Ponca City, Oklahoma, in May, 1941; graduated and commissioned from the Army Air Corps Pilot Training School, Ellington Field, Texas, December, 1943; received the Bachelor of Arts degree from Bethany Nazarene College, Bethany, Oklahoma, with majors in philosophy and history in May, 1950; received the Master of Arts degree from East Tennessee State University, Johnson City, Tennessee, with a major in library science, August, 1962; completed the requirements for the Doctor of Education degree in higher education at Oklahoma State University, Stillwater, Oklahoma, May, 1967.

Professional Experience: Entered the United States Army Air Corps in 1942, serving three years as an aircraft commander (pilot in heavy bombardment) in the Eighth Air Force, European Theater; served as a classroom teacher, coach, vocal music director in public schools in Arkansas and Tennessee, director of instructional materials center, Montgomery County Maryland, 1950-1963; education librarian at

Oklahoma State University, Stillwater, Oklahoma, 1963-1967; Associate Director of Library Services and Associate Professor of Library Science, Western Kentucky University, Bowling Green, Kentucky, 1967.

Professional Organizations: Phi Delta Kappa, American Library Association, Association of College and Research Libraries, Oklahoma Library Association, Southwest Library Association, National Education Association, American Association of University Professors.