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AN EVALUATION OF CLOSED-CIRCUIT TELEVISION AS A MEDIA IN TEACHING AN OPERATION IN ELECTRONICS BY USE OF THE DEMONSTRATION PROCEDURE

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A Thesis Submitted to the Graduate Division in Partial Fulfillment of the Requirements for the Degree of Master of Science

By

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ABSTRACT OF THESIS

The purpose of this study was to compare the relative effectiveness of a conventional face-to-face demonstration with a closed-circuit televised demonstration on trouble-shooting with the Simpson Volt-Ohm-Meter.

Special emphasis was placed on problems the ordinary shop instructor would have in presenting a demonstration by television.

Preparation prior to the experimental portion of the study included: (1) the design and construction of the visual materials to be used in the demonstrations; (2) operating a television camera for a number of demonstrations in elementary school methods; (3) writing a television script; (4) preparation of the pretest and the post test; (5) preparation of the critique questionnaire; (6) trial runs of the conventional and televised demonstrations.

Data for the experimental comparison of the conventional demonstration with the televised demonstration were obtained by the parallel group technique.

Two groups, experimental and control, composed of graduate students in the field of industrial education were used in the experiment. Subjects of both groups were compared on the characteristics of age, position, and over all grade point average.

A pretest over the informational content of the demonstrations was administered to both groups. The control group observed the demonstration in a conventional face-to-face classroom situation. The experimental group viewed the demonstration by closed-circuit television. A post test was administered to each group at the conclusion of the two demonstrations. The experimental group was asked to complete a critique questionnaire on the effectiveness of the televised demonstration.

Pretest-post test scores of the control group and the experimental group were compared by several statistical techniques. Values of mean and standard deviation obtained from post test scores were used to match the two groups in mean ability. Group mean scores were also evaluated by the statistical technique analysis of variance.

The following conclusions were formulated at the completion of this study.

1. The demonstration on troubleshooting with the Simpson Volt-Ohm-Meter was as effective by television as it was by the conventional face-to-face classroom method.

2. Both methods are effective ways of teaching how to use the Simpson Volt-Ohm-Meter.

3. It is possible for inexperienced instructors, after a relatively short period of training, to become in general effective instructors in using the media of television.

4. Closed-Circuit television systems with medium definition (400 lines) vidicon television cameras can be used in televised demonstrations, except in discerning fine details.

5. One of the most difficult problems of teaching a demonstration by television is that of maintaining proper eye contact with the television camera.

CHAPTER I

INTRODUCTION TO THE STUDY

Numerous studies have been completed by various organizations and individuals on the media of educational television. This research has, for the most part, focused its attention on a comparison of conventional fact-to-face instruction with televised instruction. The effectiveness of televised instruction has been proven many times, yet there are many questions to be answered before educational television will realize its maximum potential. These questions center around its best use in various teaching situations.

In this study a comparison of conventional face-to-face instruction with televised instruction was made, but it was not the only objective of the study. Its objective was to check the effectiveness of the televised demonstration and to reinforce stated conclusions.

Statement of the Problem

The purpose of this study was to compare the relative effectiveness of a conventional face-to-face demonstration with a televised demonstration when teaching how to use the Simpson Volt-Ohm-Meter in troubleshooting electrical devices. It further attempted to ascertain what research had been

done recently in the area of educational television and the special problems involved in teaching by television.

Sources of Data and Method of Study

A portion of the data for this study was obtained from books, articles, and research studies concerned with educational television. The libraries of Kansas State College of Pittsburg and Washington University in St. Louis were used to obtain a large portion of the research data. A smaller portion of this data was obtained by correspondence with institutions and organizations concerned with research in televised instruction. Primary data were obtained by observation and experience in operating a television camera at the television demonstration room located in the Horace Mann Laboratory School, Kansas State College of Pittsburg.

Data for the experimental comparison of the conventional demonstration with the televised demonstration were obtained by the parallel-group technique. Two groups, experimental and control were formed from two intact groups of graduate students in the field of industrial education. The control group received instruction on troubleshooting with a Simpson Volt-Ohm-Meter by conventional face-to-face instruction. The experimental group received the same instruction via closed-circuit television. All other experimental variables, except instruction by television, were reduced to minimize their effect on the experiment.

Preparations for the experimental portion of the study, first of all, included construction of the necessary visual materials and operation of the television camera for a number of demonstrations concerned with teaching a class in elementary school methods. The visual materials used in the conventional and the televised demonstrations included an enlarged model of the Simpson Volt-Ohm-Meter and two base cards. One of the base cards had the title of the demonstration printed on it and the other contained the key points and a summary of the demonstrations.

Other initial preparations included the development of a television script or run-down sheet and the pretest and the post test. The run-down sheet contained both audio and video portions and was used in both demonstrations. The items for the pretest and the post test were obtained from the operator's manual of the Simpson Volt-Ohm-Meter. Content validity of the tests was established by two instructors in the field of electricity and electronics. Trial forms of the tests were given to several people who were not familiar with the lesson content of the demonstrations. The simplified method of rational equivalence was used to determine the reliability coefficient of the pretest and the post test scores. Also developed was a critique questionnaire which was used to ascertain student reaction to the televised demonstration. The questionnaire was concerned with an evaluation of the instructor, visual materials,

and lesson content of the televised demonstration.

Final preparations, before the actual demonstrations were given, included a number of trial runs of the conventional and televised demonstrations, and the selection of subjects for the experimental group and the control group. The conventional face-to-face demonstration required one trial run which was given to a class of graduate students enrolled in a course in electricity at the college level. Three trial runs of the televised demonstration were necessary for the preparation of the televised demonstration. The subjects who composed the two groups, experimental and control, were obtained from two classes in the field of industrial education. Subjects of the experimental group were obtained from the course, The General I. A. Program. Students for the control group were obtained from the course, Philosophy of Vocational Education. Initially both groups were to be matched in ability with the results of the Miller's Analogy Test. The researcher was not able to obtain these scores so other means had to be used to gain some knowledge of the two groups. The two groups were compared on the characteristics of age, position, and overall grade point average. With the use of the pretest the two groups were compared on knowledge of the lesson content of the demonstrations.

In execution of the experimental portion of the study, the two groups, experimental and control, received

the pretest on the same day during their respective class periods. Four days later the control group saw the conventional face-to-face demonstration on troubleshooting with a multimeter then took the post test over the demonstration. The following day the experimental group saw the same demonstration by closed-circuit television, took the post test and filled out the critique questionnaire.

Various statistical methods were used to compare the results of the pretest and the post test scores of the experimental and control groups. Analysis of variance was used to compare the mean test scores of the experimental and control groups. Since the subjects of both groups were not matched person for person values of mean and standard deviation were used in matching the two groups.

Importance of the Study

The need for this study is based on the fact that a limited amount of research in the use of televised instruction in the field of industrial education has been done. Of the research that has been conducted, a limited portion has been concerned with presenting entire demonstrations by television. The researcher does not contend or imply that a major portion of the instruction of a course in the field of industrial education could be taught by television. He contends that televised instruction can be effective in certain teaching situations in the shop and industrial

laboratory. For example, televised instruction may have immediate application in large metropolitan school systems where limited shop facilities and over-crowded conditions exist. Television might be used to present quality instruction by master teachers in current up-to-date industrial processes to keep pace with the rapid advances in industrial technology. Television may be used most effectively in teaching courses such as electronics and electricity which involve more technical knowledge and less emphasis on learning skills. The present study is directly concerned with the application of televised instruction because this study is concerned with some of the problems the ordinary instructor in the field of industrial education might come in contact with in teaching by television.

Limitations of the Study

The experimental portion of this study does have certain limitations. These limitations should not affect the overall results of the study since they possibly will not seriously interfere with the major findings and conclusions of the study. One of the factors which would affect the accuracy of the statistical data would be the length of the demonstration, which was restricted to a limit of twenty minutes. In a conventional teaching situation demonstrations are usually restricted to a limit of fifteen minutes. If the length of both demonstrations had not been restricted,

then a typical teaching situation would not have existed.

The results of the pretest and the post test were limited by the short length of both tests. The two tests contained only twenty multiple choice items each. Significant differences may have occurred, yet with insufficient test data, these differences would not have appeared. We would have committed a type II error (no significance difference where a true difference exists).

Another limiting factor which might have affected the results of the experimental portion is the total number of subjects used in the two demonstrations. The experimental group had a total of twenty subjects and the control group had eighteen subjects. Here again a type II error could have been committed because of the small size of both groups.

The scores of the experimental group on the post test might have been better if high definition television cameras had been used in the televised demonstration. Another factor which could have improved student understanding of the televised demonstration would have been to use two television cameras instead of one.

Other variables in the experimental portion of the study were controlled to limit their affect on the comparison of the two demonstrations. These included: (1) the same instructor was used in both demonstrations; (2) the same tests were administered to both groups; (3) the same lesson plans and visual materials were used in both demonstrations.

Definition of Terms

Closed-Circuit Television. This is a television system which, in its simplest form, consists of a television camera and receiver connected with coaxial cable. There are two basic systems of closed-circuit television, video and radio frequency. In the radio frequency system a composite signal composed of the audio and video pulses is broadcast to the television receiver. The video system differs from the radio frequency system in that both signals, audio and video are transmitted separately.[1]

Demonstration Procedure. This procedure is the most definite and valuable means of learning manipulative skills. The procedure is usually broken down into four steps: preparation, presentation, application and assignment, and testing. This procedure involves both telling and showing; it is based on the principle that concious imitation is a factor in learning.[2]

Multimeter. This term is defined as a test instrument having several different ranges for measuring voltage, current, and resistance.[3]

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[1]Costello and Gordon, Teach with Television (New York: Hasting House, 1961), p. 65.

[2]Emanuel E. Ericson, Teaching the Industrial Arts (Peoria, Illinois: Chas. A. Bennett Co. Inc., 1960), pp. 72-74.

[3]Robert E. Beam (ed.), Dictionary of Electronic Terms (sixth edition: Chicago: Allied Radio, 1961), p. 45.

Parallel-Group Technique. This is a procedure where two groups of nearly equal ability are used in an experimental situation. Conditions of the situation are controlled as carefully as possible, except for one variable or experimental factor, which is varied for one group (the experimental group). The other group (the control group) is used for comparative purposes, undergoing customary or non-experimental conditions.[4]

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[4]Good and Scates, Methods of Research (New York: Appleton-Century-Crofts, Inc., 1954), p. 705.

CHAPTER II

REVIEW OF PREVIOUS RESEARCH AND THEORY

Chapter one of the study was concerned with the preliminaries of the study. These preliminaries included a statement of the problem, importance of the study, its limitations, source of data, and a brief outline of the procedures to be used in carrying out the experimental portion of the study. Chapter two is concerned with a review of research in the use of televised instruction in education.

Background of Educational Television

Probably no development in methods of teaching has been subjected to such a wide-spread and vigorous evaluation by various research organizations. There can no longer be any doubt that students learn efficiently from televised instructions. This fact has been demonstrated many times over in this country and abroad.

The first attempt at televised instruction took place at the Iowa State University in 1932.[1] Video transmission was accomplished with a "scanning disc" system instead of a

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[1] Educational Television The Next Ten Years. Stanford, California, prepared and published by the Institute for Communication Research, Stanford University, 1962, p. 334.

picture tube. Over 400 programs including lectures in various subjects as well as entertainment were presented by the station between the years of 1932 and 1939. The Philadelphia Public Schools began televised instruction on a regular basis in 1948.[2] About the same time, the United States Navy, Pennsylvania State University, and the United States Army were involved in programs of research in the field of educational television.

In 1955 extensive experimentation in the use of television for presentation of classroom instruction was extended to both the public and college level.[3] At the public school level, televised instruction was broadcast by educational or commercial television stations to classrooms in the reception area. At the college level, televised instruction developed principally by a different pattern. Lectures and demonstrations were transmitted to classrooms by closed-circuit television systems. A factor in the development of these closed-circuit television systems was the invention of the vidicon television camera. Initial costs of closed-circuit systems were reduced by as much as twenty to forty thousand dollars. Closed-circuit

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[2]Using Television in the Classroom, Edited by Mary Howard Smith (New York: McGraw-Hill Book Company, 1961), p. 6.

[3]Leslie P. Greenhill, "Closed-Circuit Television for Teaching in Colleges and Universities," University Park, Pennsylvania, Pennsylvania State University, 1959, p. 1. (Mimeographed).

television became a sort of do-it-yourself media. Numerous comparisons of televised instruction with face-to-face classroom instruction were conducted. The experimental designs of many of these comparisons were not well planned and their results were not too accurate. In the years of 1957, 1958, and 1959 many improvements were made in these designs which led to more meaningful conclusions.

Televised Instruction in Industrial Education

Barnard conducted extensive research in the application of simple industrial type television equipment (on the single room concept) to improve class demonstrations.[4] In this experiment an industrial type vidicon television camera was connected to a television receiver with a short length of coaxial cable. The camera and receiver were used to show enlarged views of equipment which would not normally be visible to an entire class. These experiments were tried in an electronics' course taught by Dr. Philip Ruehl. In a personal letter received from Dr. Ruehl he indicated that the most effective use of closed-circuit television in teaching electronics was enlarging oscilloscope patterns for a class demonstration or lecture.

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[4] David P. Barnard, "Audio-Visuals," Industrial Arts and Vocational Education, Vol. 52, No. 1 (January, 1963), p. 10.

Barnard did not measure the effectiveness of his experiments. Conclusions were based on the work done with the television equipment during demonstrations in electricity and electronics. The following generalized statements were extracted from comments made by Barnard concerning the experiment.

1. The instructor should rehearse the demonstration with a student camera man if more than one camera is to be used in the demonstration.
2. Additional lighting if needed could be provided with a single one-hundred watt bulb or a number one photo flood lamp.
3. A television camera with an electronic view finder is necessary to focus the camera, otherwise, a television monitor must be used.
4. By purchasing industrial type equipment the cost of a closed-circuit television system can be held under $2,000. This only applies to equipment to be purchased for use in the single-room concept.[5]

A study on the adaptability of closed-circuit television as an instructional aid to the field of industrial arts was conducted by Whitfield.[6] Data for the study were

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[5]*Ibid*., pp. 12 and 44.

[6]Theron Wayne Whitfield, "An Investigation of Educational Closed-Circuit Television and its Adaptability to the Industrial Arts Field," Unpublished Master's Thesis, University of Minnesota, Minneapolis, 1958.

obtained from other studies and reports of research conducted in the area of closed-circuit television. The conclusions made by Whitfield in his study are given in the following statements:

> The ability [efficiency] of television to teach skills and the effectiveness of narration and demonstration through this medium indicate that within the next few years an increasing number of industrial arts teachers will make use of closed-circuit television as a medium of instruction, a teaching aid, or a public relations device. Television has been found to be particularly effective in presenting close-up demonstrations. Experienced television teachers believe that interest in the use of the medium is growing. Provisions for installation is included in most new construction.[7]

Manchak conducted a study on the use of closed-circuit television as an instructional aid in the classroom (the single room concept) at the college level.[8] Data for this experimental study were obtained through the use of a questionnaire and opinionnaire directed to the students and faculty who had an active part in the experiment. The conclusions made by Manchak in his study are presented in the following statements:

> Evidence indicated that it is possible to use low-cost closed-circuit television as an instructional aid within a single room or laboratory where "one scene" views are involved.

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[7] Ibid.

[8] Paul J. Manchak, "Direct-Camera-to-Receiver Television as an Instructional Aid to Industrial Education," Unpublished Master's Thesis, University of Maryland, College Park, 1961.

> Faculty and student response to questionnaires and opinionnaires showed these groups to be highly in favor of the closed-circuit television as an instructional aid within industrial arts laboratory courses.[9]

Tivis made a study on the development of a demonstration procedure which could be used on a commercial television station.[10] Data for the study were obtained from previous studies and reports on televised instruction. A demonstration procedure was developed, using the standard four-step procedure for presenting demonstrations in the field of industrial arts. This four-step procedure was changed to meet the needs of educational and commercial television. The necessary visual aids for the demonstration were developed, included was a simple project expanded into its basic parts. There was no mention in the study as to whether this demonstration procedure developed for television had been used in executing an educational television program. The following comments were made by Tivis regarding his study:

> It might be concluded that educational television is a very potential [may have a great potential] as an educational medium. The field of educational television is relatively new, but there is a definite trend towards organized education

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[9] *Ibid*.

[10] Harold B. Tivis, "An Established Demonstration Procedure for Presenting A Manipulative Job on an Educational Television Program" (Unpublished Master's thesis, Kansas State College, Pittsburg, Kansas, 1955).

on the television. Whenever possible, the educators should encourage the use of television in the home, school, and community as an educational device.[11]

Dr. Howard Gerrish has written an interesting report on a successful educational television presentation entitled, "Our Electronic World."[12] This weekly television series was beamed to elementary and junior high schools, in addition, to the regular viewing audience in Northern California. The purpose of the series was to correlate television instruction with recently published textbooks, "Electricity" and "Electronics" written by Dr. Gerrish. The series included a schedule of eight programs on basic electrical and electronic theory. The programs were structured around the discoveries and inventions of great scientists.

Dr. Gerrish made the following comments in his report regarding the advantages of televised instruction.

1. It is unrealistic, if not physically impossible, for a teacher to make daily lesson preparations of the same quality as a well-produced and rehearsed television production of the same lesson.

2. One well-prepared teacher, an expert in a particular field of endeavor, may present the television lesson to many students, insuring high-level creative, and inspirational teaching.

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[11] *Ibid*., p. 44.

[12] Howard H. Gerrish, "Industrial Arts Electronics for Televiewing," *Industrial Arts and Vocational Education*, Vol. 50, No. 6 (June, 1961), p. 22.

3. During the "Our Electronic World" series, each half-hour program required an average of 12 hours of preparation.[13]

Another study using closed circuit television on the single-room concept was conducted by Ernest B. Parry.[14] Several lessons were presented to college students where the objects discussed were too small to be seen by more than a few students. A television camera and receiver connected by coaxial cable were used to provide close-up views of fine details and small objects. A follow-up questionnaire was used to determine the attitudes of the students to this type of instruction. Ninety-five per cent of the group felt that the use of closed-circuit television blended in smoothly with the lesson. Eighty-eight per cent indicated that the close-up views provided by television helped them gain a better understanding of the principles and subject matter involved.[15]

Television was used by the drafting teacher in demonstrating a complicated sheet metal development. Seventy-five per cent of the students who observed the demonstration, indicated that the close-up views were helpful in gaining a better understanding of the demonstration. Fifty-seven per

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[13] Ibid., p. 23.

[14] Ernest Parry, "Try Closed-Circuit TV for Better Industrial Education," Industrial Arts and Vocational Education, Vol. 49, No. 10 (December, 1960), p. 18.

[15] Ibid., p. 18.

cent of the group indicated that they could not have understood the demonstration well without the use of closed-circuit television.[16]

Limited testing was attempted to determine the effectiveness of closed-circuit television as an aid to instruction, but due to limited time, materials, group size, and selection no conclusions were formulated.

Phares mentioned the use of commercial television as an effective way to sell industrial education to the public.[17] In the example mentioned, industrial educators were invited to discuss the future of industrial arts on a local television program. In addition to the discussion, several projects were displayed to illustrate the kinds of learning, understandings, and appreciation that accompany the student's work.

A report by Curry and Weeks was written on a series of television programs presented by the Department of Vocational Education for the Detroit Public Schools.[18] The

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[16] Ibid., p. 19.

[17] Gail Phares, "It's What's Up Front That Counts," Industrial Arts and Vocational Education, Vol. 50, No. 2 (February, 1961), pp. 18-19.

[18] Estell Curry and J. W. Weeks, "Television and Industrial Arts," School Shop, Vol. 22, No. 7 (March, 1963), p. 15.

first series of half-hour programs were titled, "Alphabet of Skills." The series were presented during the school year of 1957-58. Televised instruction was presented in the subject areas of industrial education and home economics. A second series was initiated the following year entitled, "Tomorrow's Craftsman." Two and a half hours of broadcast time were allocated to this series. Lesson content included demonstrations by master teachers on the use of various materials and machines.

Since so much time was being devoted to the "Tomorrow's Craftsman" series, it was decided to correlate these televised demonstrations with instruction in the public schools. This attempt was not successful because teachers did not use the televised instruction sufficiently to warrant the effort of producing the series.

In an effort to improve correlation between televised instruction and instruction in the public schools, a new series was developed to present the major instruction of a course in household mechanics for seventh grade students. All household mechanics classes for seventh grade students in the city were scheduled at the same time. Lesson plans were developed and sent to those schools who were to take part in the televised instruction. Several workshops were held to select and train on-camera teachers.

The results of televised instruction in the seventh grade household mechanics classes has (of the writing of

this article) not been evaluated statistically.

It is the general opinion of the teachers involved that pupils do learn better when a course is taught by the method described here. The viewing pupils have a higher interest than the non-viewing pupils, and the quality of work produced was better.[19]

The advantages of teaching industrial arts courses by television greatly out-weigh the problems or disadvantages. Some of the advantages are:

1. The teachers and pupils throughout the city have the opportunity to learn from a master teacher. This provides the best kind of instruction.

2. Lessons which are presented on television require a great deal of planning. Therefore, each lesson is of high quality.

3. The on-camera teacher is given adequate time to prepare each lesson. As a result, he is able to study new industrial processes and incorporate these into the lessons.

4. Television makes it possible to use a great number of teaching aids. The average teacher would find many of these aids impossible to obtain.

5. Teaching a course by television gives unity to the course throughout the city. The best of teaching is presented at the same time.

6. The camera presents material so that it is easy to see. Small objects can be enlarged until they are as large as the viewing screen.[20]

Televised Instruction in Army Training

A full-scale test of televised instruction took place at the United States Army Basic Training Center, Fort Dix,

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[19] Ibid., p. 32.

[20] Ibid.

New Jersey in 1961. Two companies, television and conventional, were formed from a pool of incoming trainees. Armed forces qualification test scores were used to assign men from the pool to each company. Each company had a total of 156 men of nearly equal learning ability. During the eight weeks of basic training, the conventional company received a portion of its instruction in the classroom as usual. The television company received all classroom instruction by television. Basic trainees usually receive 384 hours of instruction, of this total, the television company received fifty-eight hours of instruction by television. This instruction included the assembly-disassembly of the M-1 and M-14 Rifle to lectures on military courtesy and character guidance.[21]

A television teaching procedure, labeled "review-prevue," was used to improve trainee performance in basic training. Television receivers were placed in the barracks of the television company. After the regular training for the day was completed, trainees would gather in the barracks for one hour of recorded television instruction. A review of previous training for the day or past week would be given with emphasis placed on the key points of instruction. A

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[21]Joseph Kanner and Wesley Marshall, "A Report on Television in Basic Training: The Improvement of Basic Training by Television," Audio Visual Communications Directorate for the Office of the Chief Signal Officer, April, 1963, pp. 2-3-7. (Mimeographed).

prevue of training to be given in the next few days was also presented, this material did not cover specific points of the next day's instruction so that the TV company would not have an advantage over the conventional company. It was felt that the review-prevue procedure would improve trainee performance in such situations as: the grenade range, gas chamber, or the rifle range.[22]

The results of the televised classroom instruction and the television teaching procedure, "review-prevue" may be summarized as follows:

1. The comparisons between the television company and the primary conventional company, based on immediate test scores indicated:

    a. Television instruction was in most comparisons more effective than conventional instruction.

    b. Television instruction was more effective both for low and high aptitude groups.

    c. Prior to the end of basic training, Review-Prevue had already eliminated deficiencies indicated by the immediate tests for the TV Company.

2. Comparisons between the television company, (based on final test scores), with conventional companies indicated:

    a. The learning of the television company was superior to that of the conventional companies.

    b. The learning of the lower aptitude television trainees was at least as effective as the learning of the higher aptitude conventional company trainees.

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[22] *Ibid.*, p. 6.

c. The superior performance of the television company appears attributable to the review-preview procedure.

3. Administratively, the use of television eliminated requirements for 165 man hours of live instruction. It was determined that this elimination could be extended to 254 hours which could be presented by television.

4. Additional advantages of television were:

a. Standardization of training at an effective level.

b. Mobilization requirements for additional instructors are reduced or eliminated.

c. New training requirements can more easily be incorporated, e.g., review opportunities, new subject matters, changes in scheduling, etc.[23]

Televised Instruction in Air Force Training

A very successful closed-circuit television installation has been in operation since 1959 at Lowry Air Force Base, Denver. Television on the multiple-room concept was used in teaching the Bomb Navigation System Mechanic Course (Nr. ABR 32130E). The significance of this installation is that the entire course of seven hundred twenty hours of instruction is taught by television.[24]

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[23] Ibid., p. 42.

[24] John R. Manley, "Summary of Research at Lowry Air Force Base," (Denver, Colorado: Lowry Technical Training Center, undated), p. 1 (Mimeographed); Herbert P. Rumford, "An Experiment in Teaching Elementary School Methods via Closed-Circuit Television," (unpublished Doctor's Dissertation, The University of Colorado, Boulder, 1960), p. 41.

Technical facilities of the Lowry Installation were developed so that full use of all available studio techniques could be used in the instruction. Included in these facilities is a television studio with seven viewing classrooms. Each viewing classroom contains two television receivers which are placed side by side. Two television cameras are wired to separate lines leading to the seven classrooms.

> As a lesson progresses, and the instructor explains or demonstrates a device, camera A picks up the entire scene of the instructor in relation to the device, and this image shows up on receiver A in the classrooms. Simultaneously, camera B zooms in for a close-up of the device only, and this image appears on receiver B in the classrooms. Since the pairs of receivers are side by side in the classrooms, it is easy for students to retain proper orientation between the instructor and the object.[25]

To determine the effectiveness of televised instruction at the Lowry Installation, two groups, experimental and control were formed. The two groups were matched in ability, background, and other factors. Statistical methods were used in comparing the achievement of the two groups, but no claim of statistical significance was made.

> General Conclusions: While Lowry does not suggest that every course can and should be televised, they report that they have not yet encountered anything which could not be televised effectively. While new in television in terms of time, Lowry-TTC-TV is now doing 45 hours of live programming weekly. All personnel, both students and instructors, are enthusiastic and feel that the resources of the television medium are just beginning to be fully

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[25]Philip Lewis, Educational Television Guidebook (New York: McGraw-Hill Book Company, Inc., 1961), p. 55.

appreciated. The question is no longer, "Is educational television effective?" but, instead, "How effective?" This is what Lowry TTC-TV is attempting to determine.[26]

Growth of Closed-Circuit Television in American Education

A study financed by the Department of Health, Education, and Welfare dealing with the growth of closed-circuit television in American education was completed in 1963. Data were obtained from a questionnaire which was sent to all public educational, medical, and military installations with television facilities. It was estimated that five hundred closed-circuit television installations were in existence throughout the country. Of the total number of questionnaires sent, three hundred sixty-four were used in compiling the study. Twelve of these installations were located in technical and vocational schools. A major portion of the questionnaire was concerned with: (1) major subject areas televised via closed-circuit television; (2) uses of closed-circuit television other than direct instruction; (3) closed-circuit television facilities and equipment.[27]

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[26]Manley, op. cit., p. 8.

[27]Lee E. Campion and Clarice Y. Kelly, "A Directory of Closed-Circuit Television Installations in American Education with a Pattern of Growth," Occasional Paper No. 10, Studies in the Growth of Instructional Technology, II: Washington: Department of Audio-Visual Instruction, National Education Association, 1963, p. 35.

In the section dealing with major subject areas televised via closed-circuit television, science is the most televised subject area in secondary education. Following in respective order were the subject areas of social studies, language arts, and industrial arts. In higher education, language arts leads other subject fields. Following in respective order are courses in science and education, social studies, mathematics, psychology, and industrial arts and engineering.[28]

In the section dealing with the uses of closed-circuit television (other than for direct instruction), closed-circuit television equipment is used most frequently as an audio-visual tool for magnification and observation, and classroom observation in teacher education. Closed-circuit equipment has been used to observe on-going demonstrations and activities away from the origination source. In some cases, closed-circuit installations have been used to train television technicians.[29]

In that portion of the questionnaire dealing with closed-circuit facilities and equipment, most closed-circuit installations have only a limited amount of professional equipment. This equipment, besides camers and receivers, consisted of:

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[28] Ibid., p. 35.

[29] Ibid., p. 36.

1. 100-125 film and/or slide chains.
2. 37 video tape recorders.
3. 28 kinescope recorders.
4. 13 talk-back systems.
5. 2 audio and visual feedback systems.[30]

A total of eight hundred twenty-six television cameras were used in the installations surveyed. Of this total, six hundred ninety-five were vidicon cameras and one hundred thirty-one were immage orthicon cameras.[31]

In a summary of this study on the growth of closed-circuit television, these comments were made:

1. Today there are approximately 500 CCTV installations in educational, medical, and military institutions.

2. CCTV has developed about twice as rapidly in institutions of higher education than in schools K-12.

3. The year 1958 brought about a relatively sharp increase in the number of installations and institutions having a CCTV system.[32]

Television in College and University Training

Greenhill has done a great deal of research and written a number of reports on the subject of educational

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[30] Ibid., pp. 55-56.

[31] Ibid., p. 55.

[32] Ibid., pp. 31-32.

television.[33] This work has been directed to the use of closed-circuit television in college and university training. In this report Greenhill tells of the research that has been conducted on the effectiveness of televised instruction and the reactions of students and faculty to instruction by television.

The Pennsylvania State University has done considerable research in the field of educational television, thirty-two comparisons in seven different courses on the relative effectiveness of television with face-to-face instruction have been completed. "In 29 of the 32 comparisons, no significant differences in achievement were found."[34] Achievement was measured with above average multiple-choice tests, selected problem solving questions, and in several courses, tests of course-related attitudes. No differences were found between the two methods of instruction in achievement or in the results of tests on course-related attitudes.[35]

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[33] Leslie P. Greenhill, "Closed-Circuit Television for Teaching in Colleges and Universities," University Park, Pennsylvania: Division of Academic Research and Services, The Pennsylvania State University (January, 1962).

[34] Ibid., p. 5.

[35] Ibid.

The reactions of faculty members to instruction by television were shown in a number of surveys conducted at Penn state. A survey of faculty members who were not involved in televised instruction revealed: "A small group is quite negative toward television, and another small group is willing to try television if it should become a necessity, and a very large group (perhaps 50% of the faculty) is neutral or slightly negative."[36] It was Greenhill's opinion, that the reluctance of college faculties to accept televised instruction may be due to the newness of the television media, threat of job displacement, or timidity of exposing instruction to fellow teachers.

Several methods of determining students' reaction to televised instruction at Penn State were used: (1) questionnaires, and (2) a behavioral choice following periods of instruction by television and face-to-face instruction. The questionnaire was administered to 3,000 students who were enrolled in eight different television courses. In response to the question, "What do you think about television as a means of handling courses with large enrollments?"[37] Seventy-eight per cent of these students checked either "very good" or "fairly good." Twenty-two per cent of the students checked either "fairly bad" or "very bad."[38]

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[36]*Ibid.*, p. 7.

[37]*Ibid.*, p. 8.

[38]*Ibid.*

In determining students' reactions with the behavioral choice method, televised instruction is usually selected over face-to-face instruction (with the same teacher) in a ratio of six to four. "The lowest proportion choosing TV was 33% in General Chemistry; the highest proportion was 71% in Political Science."[39]

> It would appear that lack of student acceptance is not a serious problem provided that the instruction over television is really good, and the reasons for using television and the opportunities it provides are clearly explained to students.[40]

Interaction in Learning by Television

A report on the effects of televised instruction on interaction and the role of interaction on learning was compiled from data received from a conference of audio-visual personnel held in Washington, D. C.[41]

What is interaction? "Interaction is the pattern of reciprocal effects or ideas, things, or people on each other--the reciprocal effects of stimuli."[42] In face-to-face

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[39] Ibid., p. 8.

[40] Ibid., p. 9.

[41] Finette P. Foshay, "Interaction in Learning: Implications for Television," Washington: Division of Audio-Visual Instructional Service, National Education Association, 1959. (Mimeographed).

[42] Ibid., p. 15.

instruction live interaction can take place in the following ways: between learner and learner, between learner and teacher, between learner and subject, and between learner and environment.[43]

In televised instruction live interaction is not possible. Learning is effected by two other kinds of interaction, simulated and quasi-interaction. Quasi-interaction is brought about by identification with one's representatives. This type of interaction is considered as being moderately useful in learning. Simulated interaction is brought about by the organization of stimuli in terms of the response predicted. Simulated interaction is considered to be the least effective in learning.[44]

One of the goals of televised instruction is to combine the two types of interaction, quasi and simulated, in an effective way -- to equal the results of live interaction.

> To the extent that these kinds of interaction are well handled--with understanding of the goals aimed for, with knowledge of the persons being taught, and with the ability to feel into other people as primary prerequisites--they can approach live interaction in learning effectiveness.[45]

The amount of interaction required in different learning situations varies. Interaction in knowledge-centered

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[43]*Ibid.*

[44]*Ibid.*, pp. 18-20.

[45]*Ibid.*, p. 21.

learning requires interaction between student and teacher only at certain points. For example: ascertaining prior achievement or readiness and evaluation of the learning process. Interaction in student-centered learning requires interaction between student and teacher at every stage of the learning process. Interaction in skill-centered learning plays a subordinate role, since this type of education tends to be specific and direct. The amount of interaction required in skill-centered learning is determined by the skill to be learned and the motivation of the learner. The types of interaction needed in skill-centered learning are: trial and error, directive guidance, and guidance at choice points.[46]

It would seem that knowledge-centered learning and skill-centered learning could be effectively presented by television, since interaction between student and teacher is not required at every stage of the learning process.

Critique of Previous Research

A majority of the studies reviewed in the field of industrial education did not use statistical methods to reinforce stated conclusions. Whitfield based his entire study on data obtained from other studies and reports

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[46] *Ibid.*, pp. 24-27-28.

concerned with televised instruction.[47] Manchak based the findings of his study on a questionnaire, which measured student attitudes to televised instruction. No attempt was made to determine the effectiveness of the televised instruction.[48] Parry also used a questionnaire to determine attitudes of respondents to instruction by television, but in an attempt to measure the effectiveness of the instruction, so many variables were involved that no conclusions were made.[49]

In the Lowry Study an attempt was made to compare conventional face-to-face instruction with instruction by television.[50] Experimental variables were controlled to reduce their effect on the experiment. Tests were administered to both groups so that statistical procedures could be used to compare the relative effectiveness of the televised instruction with the conventional instruction. It was reported that students taught by television learned more and retained more, but no claim of statistical significance was made.

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[47] Whitfield, op. cit., p. 111.

[48] Manchak, op. cit., p. 24.

[49] Parry, op. cit., p. 18.

[50] Manley, op. cit., p. 1.

The Fort Dix Study is an important contribution to televised research in education because the experimental design was well formulated and the variables of instruction, groups, time, and course content have been reduced to minimize their effect on the experiment.[51]

The televised series "Our Electronic World" by Gerrish is certainly a prime example of televised instruction in the field of electricity and electronics. This series and other educational programs of the "Chico State Presents" program were sufficiently successful to insure their continuance for some time.[52]

The use of televised instruction for a course in household-mechanics in the Detroit Public Schools is certainly an example of what can be done on a large scale. This example of the multiple-room concept of televised instruction may be a forecast of things to come.[53]

Much of the research done in the area of educational television is repetitious, in other words, the same kinds of comparisons between conventional and televised instruction are being made over and over again. Greenhill refers to this

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[51] Kanner and Marshall, op. cit., p. 42.

[52] Gerrish, op. cit., p. 22.

[53] Curry and Weeks, op. cit., p. 15.

repetitious research on the effectiveness of televised instruction as "quality control" research.[54]

The present study will not be a repetition of previous quality control research. The emphasis in this study was focused on effective ways of using television in the field of industrial education. Some questions left unanswered in the study by Tivis may be answered in this study.[55] A great deal of emphasis will be placed on problems the ordinary shop teacher would face in giving entire lessons or demonstrations by television. Previous studies, especially in the field of industrial education were not evaluated statistically, the present study will be evaluated to reinforce stated conclusions.

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[54] L. P. Greenhill, "New Directions for Communication Research," Audio-Visual Communication Review, University Park, Pennsylvania, The Pennsylvania State University, (May, 1959), p. 11. (Mimeographed).

[55] Tivis, <u>op</u>. <u>cit</u>.

CHAPTER III

PLAN OF THE STUDY

In chapter two a review and critique of previous research by various institutions and organizations in the use of television as an instructional media was presented. Special emphasis was placed on research concerned with the use of closed-circuit television in the subject areas of technical and industrial education. Research was also reported dealing with the growth of closed-circuit television in American Education and the role of interaction in televised instruction.

In chapter three the problems of teaching by television and the initial steps taken in completing the experimental portion of the study was presented.

Television Facilities

This discussion will include the facilities used in completing the experimental portion of this study. These facilities include: the television demonstration room located in the Horace Mann Laboratory School and the television receiving room located in Hughes Hall, both of these facilities are located on the campus of Kansas State College of Pittsburg, Pittsburg, Kansas.

The television demonstration room was used to originate various televised lectures and demonstrations. Special

lighting was provided to insure adequate illumination for the televised instruction. The floor was covered with a rug and the windows and back wall were covered with a heavy curtain to improve the sound qualities of the room. A small control booth was located on one side of the television demonstration room. The monitor receiving sets, various switching devices, and amplifiers were located in this room.

The video equipment of the installation included three low-cost industrial type vidicon television cameras. These cameras were manufactured by the Dage Television Division of Thompson Products, Incorporated.[1] All three cameras were self-contained units and had a definition value of four hundred lines per horizontal frame. Two of these cameras had electronic view finders, which were used to follow the televised presentations. One of the cameras had a zoom lens which could be adjusted to provide close-up views of small objects. A phone jack was provided on each camera so the operator could maintain contact with the control and receiving rooms. Each television camera was connected to a separate television receiving set in the control booth. These receiving sets were used to monitor video signals received from each camera. Video signals were

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[1]Herbert P. Rumford, "An Experiment in Teaching Elementary School Methods via Closed Circuit Television," Unpublished Doctor's Dissertation, The University of Colorado, Boulder, 1960.

transmitted from the television demonstration room to the receiving room by coaxial cable. The video portion of the televised instruction was viewed from three twenty-seven inch television receivers located at the front of the receiving room.

The audio equipment of the installation consisted of five microphones, audio mixer and amplifier, and several speakers in the receiving room of Hughes Hall. Four of the microphones (conventional type) were suspended overhead from the ceiling. The other microphone (shot gun type) was secured to a boom. All five microphones were connected in parallel to the audio mixer and amplifier. Audio signals from the amplifier were transmitted by a separate transmission line to the speakers in the receiving room. These speakers were separate units and not connected to the three television receiving sets. Additional information on the closed-circuit television facilities can be obtained from a wiring diagram of the television demonstration room found in Appendix B.

Preparation for the Experiment

Before the experimental portion of this study could be started certain initial preparations had to be made. The researcher was not well acquainted with the electronic equipment used in closed-circuit television; therefore, he was not acquainted with the problems of teaching by

television. The methods and procedures used in dealing with the problems of television limitations and the design of visual materials for televised instruction had to be learned.

Operating a Television Camera. To gain some knowledge of the electronic equipment, the Audio-Visual Director of the college suggested that the researcher work part-time as a camera operator for some of the televised demonstrations. These demonstrations were concerned with teaching a class in elementary school methods. Classes involved in the demonstrations ranged from kindergarten through the sixth grade. Teaching content of the demonstrations was divided into six units consisting of: (1) arithmetic, (2) kindergarten methods, (3) primary reading, (4) intermediate reading, (5) language arts, and (6) social studies.[2] A full-time electronics technician from the Audio-Visual center of the college was responsible for the technical operation of the television cameras and other pieces of equipment. Several part-time employees were needed to operate the cameras, provide feedback from the receiving point, and assist the technician in the control room.

The researcher was responsible for the operation of the television camera with a zoom lens. It was his responsibility to follow the instructor of the televised methods

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[2] Ibid., p. 55.

demonstrations. When important visual materials were being presented, the researcher would adjust the zoom lens for a close-up view. Since the teaching situation of the methods demonstrations was to be kept as normal as possible, the teachers conducted their classes as if the television cameras were not there.

Many of the limitations of television teaching observed by the researcher were presented in a report on training television instructors. The following limitations were cited: (1) new instructors move too rapidly before the television camera; (2) unnecessary movements such as fidgeting and moving about are distracting on television; (3) habituation with the medium of television eliminated or eased nervous tensions.[3]

Teachers who have a difficult time adapting to television teaching are those who speak at a rapid rate and experience frustration when required to slow their rate of speaking. Those who enjoy television teaching are able to express themselves well, have a relaxed manner, and able to adapt themselves to studio conditions. Some of the basic requirements necessary to do an effective job of television teaching are:

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[3]F. Fritz Martin and others, "Survey of Television Utilization in Army Training," Human Engineering Report SpecDevCen 530-01-1, Ames, Iowa: Iowa State College (December, 1952). (Mimeographed).

1. Effectiveness as an instructor in the conventional classroom situation. (Television does not make good instructors out of poor ones. Knowledge of and enthusiasm for subject is important and shows through on television).
2. An honest and sincere desire to take advantage of the use of TV.
3. A warmth of dynamic quality which enables the instructor to "get out of the box" and maintain contact with the students.
4. An imagination to adapt the course content to exploit the full potentials of television.
5. A willingness to plan and thoroughly prepare each television lesson in advance of its presentation.
6. Finally, a willingness to use the services of his coordinator, the TV facilities and the reactions of his students and colleagues in a constant effort to improve his instructional techniques.[4]

Construction of Visual Materials. Before developing visual materials for the conventional and the televised demonstrations, the limitations of television had to be taken into consideration. For example, tall slender objects do not show up well because they don't conform to the aspect ratio of the viewing screen of the television receiver. Glazed or reflecting surfaces cause a blurred effect when viewed by television. Transparent materials such as glass or plastic give an illusion of transparency. Certain colors will not show up well on television; dull light grey tones against dull arkd greys give the best contrast. Materials with rough surfaces, such as wood or cork give the best

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[4] Dennis Sherk and Luther Kepler, Jr., "Guide for Television Instructors," Division of Academic Research and Services, University Park, Pennsylvania: The Pennsylvania State University, 1961, pp. 2-3.

visibility on television. A light figure against a dark background is more clearly visible on television.[5]

In a discussion with the electronics instructor of the college about the lesson content of the demonstration, the researcher came to the conclusion that a demonstration on the operation of the Simpson Volt-Ohm-Meter would be an excellent subject for the conventional and televised demonstrations. The electronics instructor used the Simpson Meter in his classes but was unable to demonstrate its use to more than a few students because of its small size. An enlarged model of the meter would provide a visual aid which could be used in the demonstrations and the classroom later on.

Before the construction of the model could begin, certain visual principles for training by television were taken into consideration. The following visual principles were used:

1. Avoid translucent materials.
2. Avoid glazed or reflecting surfaces.
3. Rough surfaced wood and paper give the best visibility.
4. Fine line charts, such as schematics, printed in black on white are more effective than those printed in white on black.
5. Three dimensional objects should be surrounded by as much air as possible.
6. Moving parts on a device should operate slowly.[6]

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[5]Fritz and others, _op_. _cit_., pp. 1-2.

[6]_Ibid_., pp. 2-3-110.

In drawing the plans for the model of the meter the actual dimensions were increased four times, in other words, the model was four times larger than the actual meter. Since the face of the actual meter contained many small numbers and figures, it was suggested that the meter face be removed and enlarged by the process of off-set printing. A print of the enlarged negative was made on plan paper rather than glossy paper because reflecting surfaces do not show up well on television.

The front and back of the model were made of masonite and plywood. The sides were made of poplar and secured to the front and back with glue and brads. The actual dimensions of the model were twenty inches long, twenty-nine inches high, and one and one-half inches deep. The zero adjust knob, function switch, and selector switch were made from white pine, two inches thick. The meter face was secured to the back of the model with rubber cement. An electric marking tool was used to scribe the symbols on the meter panel. A coat of flat black enamel was applied to the model and the inscribed symbols were brought out with white India Ink. Additional details can be obtained from a picture of the model in Figure 1 on the following page.

To surround the model with as much air as possible, an off-set metal stand was constructed. The stand consisted of a piece of band iron formed into a V-shaped base and a piece of pipe. The base and pipe were fastened

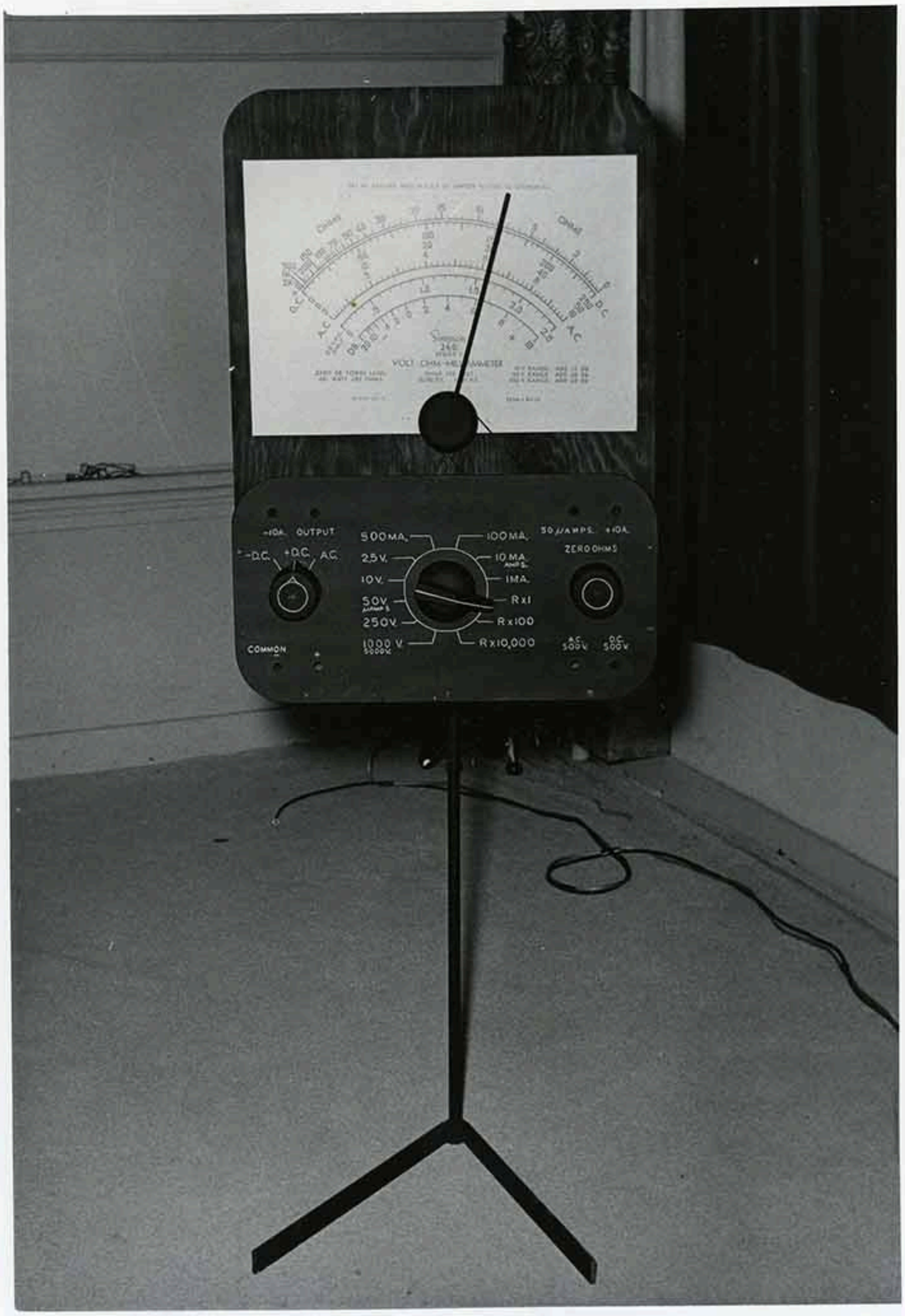

FIGURE 1

MODEL OF THE SIMPSON MULTIMETER

together by welding. A bracket made of a piece of band iron and round mild steel was fastened to the model. The purpose of the bracket was to secure the model to the stand.

To make the model more life-like, a pointer was added to illustrate scale readings on the meter face. The pointer was controlled by the zero adjust knob by means of a direct-drive pulley system. This was very helpful in demonstrating how to "zero" the multimeter.[7]

The other visual materials used in the demonstrations were determined by the capabilities of the closed-circuit television facilities. The medium definition vidicon television cameras could not be used in presenting certain visual materials. For example, photographs and typewritten materials did not show up well. Two by two slides could have been used, but the effort of producing them and the equipment needed for viewing them required too much time and effort in comparison with their instructional value to the demonstrations.

The researcher decided to limit the visual materials to several base cards with the important points of the demonstration printed on them. The chalkboard was also used in stressing certain key points.

One of the base cards contained the title of the demonstration, A Demonstration of Troubleshooting With a

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[7] Operator's Manual. Simpson Volt-Ohm-Milliammeter 260, Series III, Chicago: Simpson Electric Co., 1959.

Multimeter. The letters of the title were cut out of bright yellow construction paper. The title was displayed on a base card of plain blue bristol cardboard. The dimensions of the base card were twenty inches high and twenty-five inches long. The height-to-width dimensions were designed with the proper aspect ratio of the television camera and viewing screen on the receiving set in mind. This type of chart is not recommended by the researcher because of the time required to cut out the letters and place them in position on the base card. A picture of the show title can be seen in Figure 2 on the following page.

The following is a list of rules that apply in making visual materials for televised instruction.

1. Letters and numbers should be separated by approximately one stroke width.
2. Letters, numbers and important detail should always be light against a dark background.
3. Light yellow against dark red or dark blue gives good contrast.
4. Height-to-width ratios should be from 3X4 to 4X4.
5. Detail must be proportional to the total size of the device.

The other base card used in the demonstrations contained the key points of the demonstration procedure and the procedure for zeroing the multimeter. Since the other base card required a great deal of time to make, the researcher decided to print the letters on this card instead of making them. Letters were printed on small pieces of

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[8]Fritz and others, op. cit., pp. 3-4.

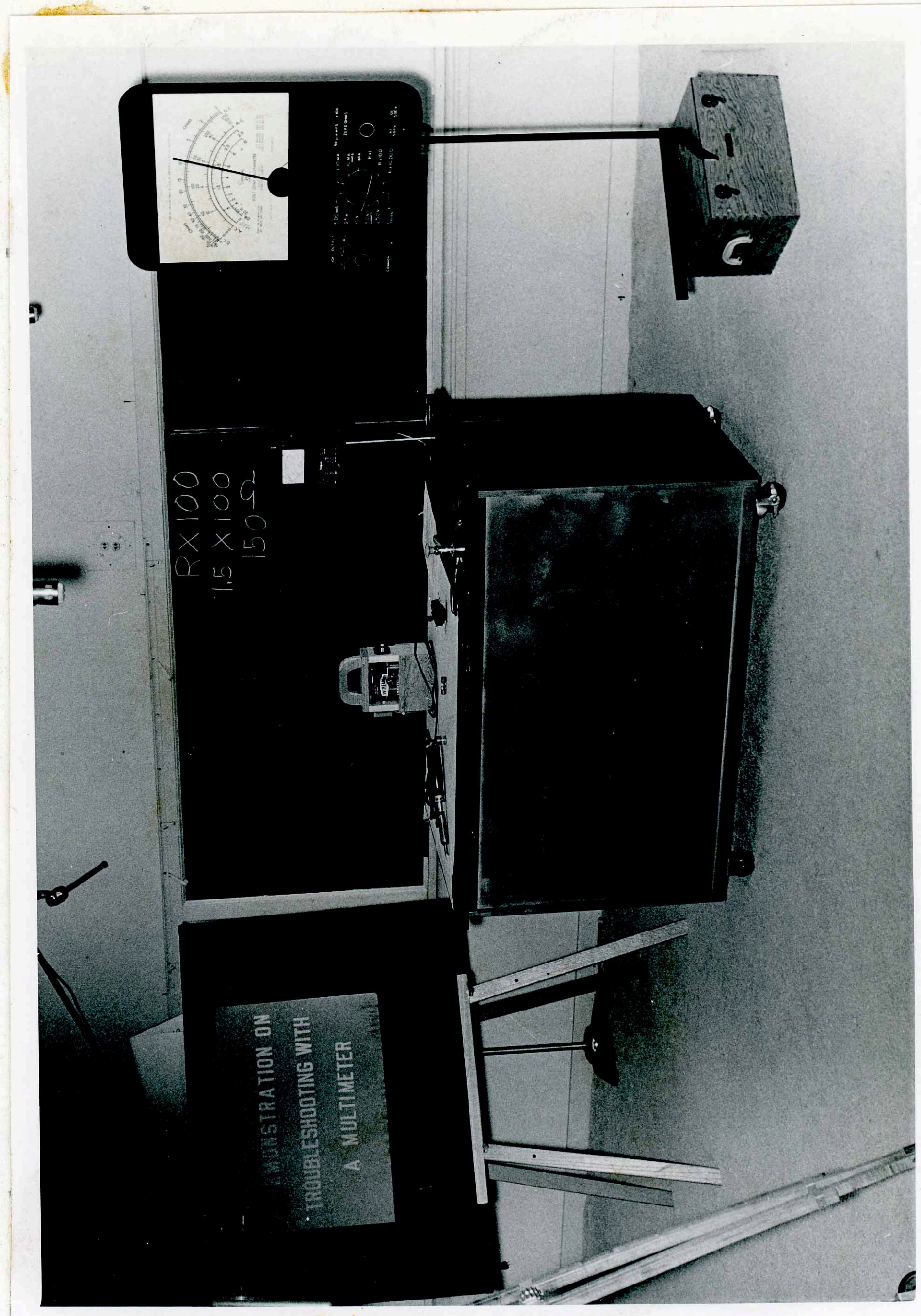

FIGURE 2

SET OF THE TELEVISED DEMONSTRATION

plain blue bristol cardboard with a speedball pin using white India Ink. The blue pieces of cardboard were attached to a black base card.

Other suggestions for preparing visual materials for televised instruction:

1. Keep your visuals simple. Don't clutter them up so that the significance of the message is lost among unimportant and perhaps distracting details.
2. Use the proper aspect ratio (proportions), i.e., visuals should be approximately 3 units high by 4 units wide to fit camera framing and viewing screen.
3. Use the horizontal rather than the vertical format in the selection and design of visuals.
4. In the preparation of charts, allow a 2" margin around the edges, to insure proper framing of the visual materials.[9]

Television Run-down Sheet. The run-down sheet or television script in its simplest form is a teaching outline which contains both the "video" and "audio" portions of the televised lesson. The audio portion is concerned with the spoken word in the televised lesson and video portion is concerned with the picture image that is to be "seen" on the television screeen. The broad movements of the instructor and the various visual materials to be used are given in the video portion.

A successful televised presentation is very definitely affected by how well the run-down sheet has been prepared. It provides the production staff with an outline of the

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[9]Sherk and Kepler, op. cit., p. 7.

lesson and in the order and at what points various visual materials will be needed. If the television camera operator has an idea of the presentation sequence, he will do a much better job following the presentation. A fundamental principle of lesson planning for television is: "everything presented in front of the camera must be planned."[10]

The researcher received a television script (run-down sheet) from the United States Army Signal Center and School at Fort Monmouth. The audio portion of the script was written in detail. The video portion was added by the production coordinator during a planning session or trial run of the televised instruction. The researcher attempted to use such a detailed script but found it almost impossible to use in a televised demonstration. When demonstrating a skill or operation by television, there are so many things to think about and do that the instructor does not have time to look at such a script constantly.

Since the researcher was not experienced in presenting demonstrations by television, his early preparations in writing the run-down sheet were based on previous experience in preparing conventional demonstrations. The demonstration on the multimeter was analyzed first with an

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[10] Lawrence F. Costello and George N. Gordon, Teach With Television (New York: Hasting House, Publishers, 1961), p. 72.

operations breakdown-sheet.[11] Operating steps and key points of the demonstration were placed in logical order. The television run-down sheet of the demonstration was written according to the format of the conventional four-step demonstration procedure: (1) preparation, (2) presentation, (3) application and assignment, (4) testing.[12]

The opening statement of the demonstration was completely written out and memorized by the instructor. This was done to reduce nervous tension, loss of words, and to provide momentum to the instructor in presenting the demonstration.[13] While the statement was being presented, the camera man had the camera placed directly in front of the instructor at normal eye level to establish the nature or location of the action. This is called "an establishing shot."[14] The preparation and presentation steps of the television run-down sheet were the same in form as those of a conventional demonstration. The application and assignment step differed from the procedure used in a conventional

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[11]Mimeographed from obtained from an instructional methods class at Kansas State College of Pittsburg.

[12]Ericson, op. cit., pp. 73-74.

[13]Costello and Gordon, op. cit., p. 73.

[14]Richard Hubbell, Television Programming and Production, Second Edition (New York: Rinehart and Company, Inc., 1950), p. 96.

demonstration. In this televised presentation it would have been difficult to test the students directly and correct their mistakes on the material covered in the demonstration; therefore, a review of the key points and operative "steps" was presented in the application step. This procedure was used in both the conventional and televised demonstrations in this experiment, to insure equal instruction to both groups. In the testing step of the television run-down sheet a short statement or summary was given by the instructor before the post test was administered to the subjects of the respective groups. This short closing speech is called a "pad" which is used on commercial television by announcers to regulate the length of a presentation.[15] An example of the television run-down sheet used in the two demonstrations is presented in Appendix B.

Suggestions for presenting a televised demonstration are given in the following statements.

1. Materials, equipment, and apparatus should be available and checked well in advance.
2. Show how something operates rather than telling about it.
3. Keep the program moving smoothly.
4. Do not move too fast. Allow time for a clear explanation.
5. Work toward the camera and be sure that your operations are clearly visible.[16]

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[15]Costello and Gordon, *op. cit.*, p. 74.

[16]Donald G. Tarbet, *Television and Our Schools* (New York: The Ronald Press Company, 1961), p. 177.

Trial Runs of Demonstrations. Several trial runs of the conventional demonstration and the television demonstration were made before the actual demonstrations were presented. Three trial runs of the televised demonstration were necessary before the instructor had sufficient confidence to present the televised demonstration. The conventional demonstration required one trial run. This is an indication of the difference in the two types of demonstrations.

The conventional trial run was given in a course in Applied Electricity, Advanced Techniques. Five students were involved in this demonstration. They were tested at the end of the demonstration to determine how much they had learned. The instructor was very much at ease, and all the visual materials worked very well. The students could see and understand the operation of the model of the multimeter. The only bad feature of the trial run was that the demonstration extended ten minutes over the proposed schedule.

A major portion of the first trial run of the televised demonstration was devoted to establishing the correct viewing position for the visual materials. For example, the actual Simpson multimeter was suspended from a ring-stand to get as much air around it as possible. The model of the multimeter was placed on a wooden box. It was found that the model could be picked up better by the camera at this higher level. The items to be tested in the demonstration

were placed on a piece of light colored cardboard. It was found that small objects will show up better if placed against a light background. The base cards were placed on a felt board easel located near the demonstration table. The television monitor was placed near the television camera, so the instructor could observe how well the visual materials could be seen. The researcher drew a rough sketch, or floor plan, of the set so the materials could be positioned correctly in the remaining demonstrations. A drawing of this floor plan is given in Appendix B.

In the first trial run of the televised demonstration the instructor was ill-at-ease. The absence of students in the classroom and the television camera gave him a cold feeling. The instructor became so involved with the monitor that he could not remember what to do. This is one of the most common faults of television instructors new to the media. When the instructor's attention is diverted from the eye of the camera to the monitor, direct contact with the student may be lost.[17]

When the first trial run of the demonstration was completed, the instructor and camera operator discussed the video portion of the demonstration--the broad movements of the instructor and the sequence of visual materials. The video cues were then written in on the video portion of the

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[17]Sherk and Kepler, op. cit., p. 12.

run-down sheet.

The second trial run of the demonstration was better than the first because the instructor was more at ease and the lack of students in the classroom did not seem to bother. To prevent the instructor from watching the television monitor, the monitor was placed at an angle so the instructor could not see it directly. The instructor did have some trouble in pacing the presentation of the televised instruction. "The rate with which information is given and visual elements are presented is referred to as pacing."[18] Pacing is a problem in televised instruction because the instructor cannot see his students and, consequently, he cannot be certain whether the information is being presented too rapidly or too slowly. The following comments contain several suggestions which the instructor might use to help him pace his presentation:

1. Anticipate the difficult and complex elements of the lecture, and make certain these points are given special emphasis and adequate explanation.
2. Anticipate questions which might arise from the presentation and try to answer them at appropriate times during the presentation.
3. Build into the lecture a varied pattern of repetition so as to present information again but in a different, yet stimulating, way.[19]

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[18] Ibid., p. 5.

[19] Ibid., p. 6.

The third trial run of the televised demonstration was performed more smoothly. The instructor was completely at ease, and the camera operator could follow the video cues of the run-down sheet without difficulty. The length of the demonstration was about twenty minutes.

Selection of Groups. The subjects who composed the control group and the experimental group were all graduate students in the field of industrial education. Subjects in the experimental group were enrolled in the course, The General I. A. Program, Number 550 which met from 9:10 to 10:05 daily for a period of nine weeks during the summer of 1963. Students in the control group were enrolled in the course Principles and Philosophy of Vocational Education, Number 594, which met from 7:00 to 8:20 daily during the six weeks session.

To learn more about the groups used in the experimental portion of this study, the control group and the experimental group were compared on the characteristics of age, position, and overall grade point average. Table I on the following page is concerned with the characteristics of the experimental group. The average age of the subjects in this group was 26.3 years. The overall grade point average for the group was 2.63. A majority of the students in this group were engaged in teaching courses connected with the field of industrial arts.

Table II on page 57 is concerned with the basic

TABLE I

AGE, OCUUPATION, AND OVERALL GRADE POINT AVERAGE OF THE EXPERIMENTAL GROUP

Student	Position	Age	Grade Point Average
1	I.A. & Sc.	21	2.14
2	I.A.	25	3.20
3	Printing	25	3.48
4	Student	22	2.91
5	I.A. & Math	31	2.38
6	I.A.	28	1.83
7	I.A.	23	3.50
8	I.A. & Coach	26	2.25
9	I.A.	29	2.53
10	Printing	23	2.94
11	I.A. Drafting	26	3.00
12	Metal Crafts	32	2.30
13	I.A.	29	2.80
14	I.A. & P.E.	31	2.30
15	I.A.	29	3.30
16	I.A.	26	2.51
17	Shop Math	24	2.30
18	I.A.	25	2.00
19	I.A.	23	2.50
20	Wood & Drafting	28	2.50
	(M) =	26.3	(M)= 2.63

TABLE II

AGE, OCCUPATION, AND OVERALL GRADE POINT AVERAGE OF THE CONTROL GROUP

Student	Position	Age	Grade Point Average
1	Voc. Auto Shop	29	2.16
2	Auto Shop	28	2.45
3	Machine Shop	32	2.94
4	Voc. Auto Shop	44	2.42
5	Coordinator	37	3.20
6	I.A. & Coach	43	2.67
7	Coordinator	50	2.40
8	Voc. Machine Shop	37	----
9	Coordinator	28	2.93
10	Director, Area Sch.	40	3.00
11	Voc. Auto Shop	32	2.13
12	Voc. Printing	32	2.87
13	Auto Shop	39	2.35
14	Coordinator	28	2.02
15	Voc. Machine Shop	30	2.96
16	Wood & Drafting	27	2.07
17	Auto Shop	26	2.04
18	I.A.	34	2.13
	(M) =	34.2	(M)= 2.49

characteristics of the control group. The average age of the participants in this group was 34.2 years. When comparing the average ages of the two groups, it was found that the control group was older than the experimental group by an average value of eight years. The overall grade point average of the control group was 2.49. When this average was compared with the overall grade point average of the experimental group, it was found that the experimental group had a higher overall grade point average by a value of .14. A large number of the members of the control group were teaching courses connected with the field of vocational education. In comparison of the two groups, we find that the control group and the experimental group differ slightly on the characteristic of position.

Tests. The tests used in the experimental portion of the study were developed by the researcher. Suggestions from the text by Micheels and Karnes were used in developing the test items.[20] The informational content of the two test forms were obtained from the operator's manual of the Simpson Volt-Ohm-Milliammeter.[21] Both the pretest and the post test contained the same test items. The only difference between the two tests was a change in the order or position

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[20]Micheels and Karnes, Measuring Educational Achievement (New York: McGraw-Hill Book Company, Inc., 1950), p. 193.

[21]Operator's Manual, Simpson Volt-Ohm-Milliameter 260, Series III (Chicago: Simpson Electric Co., 1959).

of the test items on the first page of the two tests.

Several people who were not familiar with the lesson content of the demonstration were asked to take a trial form of the tests. The scores of these people were very low, all below fifty per cent. To establish the "content validity" of the tests, two instructors in the field of electricity and electronics were asked to evaluate each test item.[22] The pretest was given to five students enrolled in the course, Applied Electricity--Advance Technique 540 during the trial run of the conventional demonstration. The scores of these students were very high, with a range from nineteen to sixteen with a score of twenty possible. If several of these students had obtained perfect scores, the pretest and the post test would have been changed and made more difficult.

The pretest was administered to the control group on July 18, 1963 at 8:00 a.m. The experimental group received the pretest on the same day at 10:00 a.m. The control group received the post test immediately following the face-to-face demonstration of July 22. The experimental group received the post test immediately following the televised demonstration on July 23.

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[22]Henry E. Garrett, Statistics in Psychology and Education, Fifth Edition (New York: David McKay Co., Inc., May, 1958), p. 355.

Summary

1. The low-cost industrial type vidicon television cameras and associated electronic equipment were quite adequate for the presentation of the televised demonstration in this study.

2. Operating a television camera for the methods demonstrations was a definite help in learning how to present a televised demonstration.

3. In the design of visual materials for televised instruction, the limitations of the television media and the television facilities to be used should be taken into consideration.

4. A well planned run-down sheet is necessary for a successful televised demonstration.

5. Trial runs are necessary for a successful televised demonstration.

6. The control group and the experimental group varied slightly on the characteristics of age, occupation, and overall grade point average.

CHAPTER IV

EVALUATION OF FINDINGS

Chapter three was concerned with gathering the experimental data for the study. The special problems of developing a conventional and a televised demonstration were presented. The special problems of giving a televised demonstration were presented. A description of the visual aids and technical closed-circuit television facilities used in the televised demonstration were also presented.

Chapter four will be concerned with an analysis of the experimental data obtained from chapter three. Various statistical procedures will be used in analyzing this data. These various statistical procedures include: (1) the use of reliability coefficients to determine the accuracy of test results; (2) a technique for matching groups in terms of mean and standard deviation; (3) determining the significance of the difference between two uncorrelated means (pretest results) with the technique, analysis of variance; (4) determining the significance of the differences between correlated means (single group technique) analysis of variance. An analysis of the data contained in the critique questionnaire will also be presented in this chapter.

Test Results

The test scores of both experimental and control groups are presented in Table III on the following page. In the original design of the experiment, subjects in the control and experimental groups who had previous training in the field of electricity were to be dropped from the experiment. An examination of Table III will indicate that a majority of those subjects who had previous training in electricity had no more knowledge of the demonstration than the other subjects. Student number ten in the experimental group and student number nine in the control group were superior to the other subjects in their respective groups. They were retained in the experiment because their scores would counter-act each other.

Table IV on page 64 is concerned with the values of mean and standard deviation. Mean scores were calculated to provide a concise description of the performance of each group as a whole and to compare each group in terms of typical performance. It will be noted in Table IV that the mean scores on the pretest are exactly the same. This indicates that the performance of both groups as a whole, was the same. The mean scores obtained by both groups on the post test are not the same. A difference of .19 was obtained.

In addition to mean scores, Table IV also contains an index of variability for each set of test scores. The

TABLE III

TEST SCORES FOR EXPERIMENTAL AND CONTROL GROUPS

Experimental Group			Control Group		
Student	Pretest	Post Test	Student	Pretest	Post Test
1.	10	19	1.	12	17
2.	6	17	2.	7	
3.	10	17	3.	5	18
4.	10	18	4.	8	17
5.	8	18	5.	12	17
6.	6	17	6.	6	19
7.	11	17	7.	12	17
8.	7	17	8.	6	16
9.*	12	17	9.*	16	20
10.*	17	19	10.	6	18
11.	7	15	11.	11	18
12.	11	16	12.	8	18
13.	12	20	13.	12	17
14.	5	17	14.	10	20
15.*	9	19	15.	7	19
16.	5	18	16.*	8	19
17.*	8	19	17.	7	18
18.	13	19	18.	10	17
19*	10	18			
20.	4	18			

*May have had some knowledge of the demonstration.

index of variability used in this table is standard deviation. This is the most stable index of variability and is used quite often in experimental work and in research studies.[1] It will be noted that the amount of variability was attenuated on the post test scores of both groups.

TABLE IV

VALUES OF MEAN AND STANDARD DEVIATION FOR PRETEST AND POST TEST SCORES

	Experimental Group			Control Group	
	Pretest	Post Test		Pretest	Post Test
Mean	9.05	17.75	Mean	9.05	17.94
SD	3.20	1.228	SD	2.96	1.14

Reliability of Test Results

The simplified method of rational equivalence was used to determine the reliability coefficient of the pretest and the post test scores.[2] The reliability coefficient of the pretest, based on the scores of both groups was (.60). The reliability coefficient for the post test reached a

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[1]Henry E. Garrett, Statistics by Psychology and Education, Fifth Edition (New York: David McKay Company, Inc., May, 1958), p. 49.

[2]Ibid., p. 341.

level of (.90). This level compares with the reliability coefficients of most standard intelligence examinations.[3] The formula and factors for determining reliability coefficients are given as follows:

$$r_{11} = \frac{n\,\sigma^2_t - M\,(n-M)}{\sigma^2_t\,(n-1)}$$

Pretest: $r_{11} = .60$

Post Test: $r_{11} = .90$

r_{11} = Reliability of the whole test.

n = Number of items in the test.

σt = SD of the test scores.

M = The mean of the test scores.[4]

Groups Matched for Mean and Standard Deviation

"When it is impracticable or impossible to set up groups in which subjects have been matched person for person, investigators often resort to the matching of groups in terms of mean and standard deviation."[5] The results of the post test were used as the variable under study in comparing the final score means of the control and experimental groups. The pretest scores were used as the matching variable since

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[3] *Ibid.*, p. 351.

[4] *Ibid.*, p. 341.

[5] *Ibid.*, p. 230.

the mean scores of both groups were equal. A coefficient of correlation (r) of .20 was obtained by comparing pretest scores with post test scores of both groups. The following formula was used in matching groups in terms of mean and standard deviation.[6]

$$SE_{D_{M_1 - M_2}} = \sigma D = \sqrt{(\sigma^2_{M_1} + \sigma^2_{M_2})\ (1 - r^2)}$$

$\sigma D = .3$ 34 Degrees of Freedom

$t = .6$ t at .01 level = 2.72

The value of t .6 is much smaller than the entry of 2.72 at the .01 level. In terms of mean and standard deviation obtained from post test scores the two groups are matched in ability.

Uncorrelated Mean Scores

In Table V on the following page the mean scores of both control and experimental groups on the pretest will be compared to determine the significance of the difference between means. The statistical technique, analysis of variance will be used. This technique often provides more efficient and exact tests of experimental hypotheses than

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[6] *Ibid.*

do the conventional methods ordinarily employed.[7]

TABLE V

DIFFERENCE BETWEEN MEAN SCORES (PRETEST)
CONTROL AND EXPERIMENTAL GROUPS

Source	df	SS	MS(V)
Between means	1	.109	.109
Within Classes	36	343.681	9.513
Total	37	343.790	

F = .109/9.513 = .0114   F at .05 level = 4.10

t = F = .10677   F at .01 level = 7.376

The value of F .0114 does not reach the value of F 4.10 at the .05 level at 36 degrees of freedom. Our mean difference of "zero" must be regarded as not significant. From this comparison of mean scores it must be concluded that the experimental and control groups were equal in prior knowledge of the lesson content of the demonstrations.

Table VI will also be concerned with the significance difference between two uncorrelated mean scores. Analysis of variance will again be used to determine if the mean

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[7] *Ibid.*, p. 276.

difference of the post test scores made by the experimental and control groups is significant.

TABLE VI

DIFFERENCE BETWEEN MEAN SCORES (POST TEST)
CONTROL AND EXPERIMENTAL GROUPS

Source	df	SS	MS(V)
Between means	1	.5	.5
Within Classes	35	49.5	1.41
Total	36	50.0	

F = .35 F at .05 level = 4.12

t = .59 F at .01 level = 7.42

From Table VI F at 35 degrees of freedom, F at the .05 level = 4.12. Our F of .35 does not reach the .05 level so that our mean difference of .19 must be regarded as "not significant." From these findings it must be concluded that the control and experimental groups were equal in the amount of knowledge gained from the demonstrations.

Correlated Mean Scores

Table VII will also be concerned with a comparison of mean scores. In this table analysis of variance is used to determine if the mean scores of the pretest and post test made by the control group changed enough to be significant. "When a test is given and then repeated, analysis of variance may be used to determine whether the mean change is significant."[8]

TABLE VII

DIFFERENCE BETWEEN MEAN SCORES (PRETEST AND POST TEST) CONTROL GROUP

Source	df	SS	MS(V)
Between Trials	1	652.97	652.97
Among Subjects	16	86.89	5.43
Interaction	16	78.53	4.908
Total	33	818.39	

F trials = 133.04 F at .01 level = 8.53

F subjects = 1.110 F at .05 level = 2.42

[8] Ibid., p. 291.

In discussing the findings of Table VII on the preceding page it is noted that F for trials is much larger than the 8.53 we find in Table F at the .01 level.[9] It is concluded that the control group learned a significant amount from the demonstration. The value of F for subjects 1.110 is much smaller than the 2.42 we find in Table F at the .05 level. It is concluded that the subjects of the control group did not differ significantly from one another in the amount of knowledge learned from the conventional face-to-face demonstration.

In Table VIII on the following page it is recorded that the value of F for trials for the experimental group is much larger than the 8.18 value in Table F at the .01 level. It is concluded that the experimental group learned a significant amount from the televised demonstration. The value of F for subjects is slightly larger than the 2.195 value in Table F at the .05 level. "If the F test refutes the null hypothesis we may use the (t) test to evaluate mean differences."[10] From Table D, 361 degrees of freedom, a (t) value of 1.97 is given at the .05 level.[11] Since the value of (t) obtained from Table D is larger than the value

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[9]*Ibid.*, p. 452.

[10]*Ibid.*, p. 287.

[11]*Ibid.*, p. 449.

of (t) for subjects at the .05 level, it is concluded that the subjects of the experimental group did not differ from one another significantly. They learned approximately the same amount from the televised demonstration.

TABLE VIII

DIFFERENCE BETWEEN MEAN SCORES (PRETEST AND POST TEST) EXPERIMENTAL GROUP

Source	df	SS	MS(V)
Between Trials	1	874.4	874.4
Among Subjects	19	208.1	10.95
Interaction	19	84.9	4.46
Total	39	1,067.4	
F trials = 196.05	F at .01 level = 8.18		
F Subjects = 2.45	F at .05 level = 2.195		
t = 1.55	t at .05 level = 1.97		

Critique of Televised Demonstration

Table IX on the following page will present the findings of a portion of the critique questionnaire. This portion is concerned with an evaluation of the instructor's speech, body movement, composure, and eye contact with the camera.

Table IX includes three more total responses than there were subjects in the experimental group. These extra responses

TABLE IX

EVALUATION OF THE INSTRUCTOR
TELEVISED DEMONSTRATION

Rate of Speaking	
1. Too fast	0 Responses
2. About right	17
3. Too slow	6
Clarity of Speech	
1. Good	19
2. Fair	4
3. Poor	0
Body Movement	
1. Too rapid	0
2. All right	22
3. Distracting	1
Eye Contact with the Camera	
1. Good	5
2. Fair	14
3. Poor	4
Composure	
1. Relaxed	16
2. Nervous	6

were interested students who watched the demonstration. The instructor was rated quite well by the group on rate of speaking, composure, body movement, and clarity of speech.

Six of the respondents did feel that the rate of speaking was "too slow" so this point cannot be rated as highly as the others. Eye contact with the camera was rated heavily in the "fair" column with a slight edge to the "good" over the "poor" in rating.

Table X on the next page will be concerned with an evaluation of the visual aids and lesson content of the demonstration. A majority of the respondents indicated that the charts and model of the multimeter were "easy to see." This response was expected because the charts and model had been designed especially for the televised demonstration. The actual Simpson multimeter, being much smaller in size than the model, could not be seen as well. A majority of the respondents indicated that the actual multimeter was "fairly easy to see." In an evaluation of the lesson content of the televised demonstration, a majority of the respondents thought that the demonstration procedure was presented in a "clear step-by-step manner." About half of the respondents indicated that the demonstration was "too long." The other portion thought that the demonstration was "about right" in length.

TABLE X

EVALUATION OF THE VISUAL AIDS AND LESSON CONTENT OF THE TELEVISED DEMONSTRATION

Charts and Model of the Meter	
1. Easy to see	18 Responses
2. Fairly easy to see.	4
3. Hard to see	0
The Actual Multimeter	
1. Easy to see	6
2. Fairly easy to see.	14
3. Hard to see	3
Demonstration Procedure	
1. Clear step-by-step.	17
2. Fairly well organized . . .	5
3. Not well organized.	0
Length of the Demonstration	
1. Too long.	11
2. About right	12
3. Too short	0

Additional comments on the televised demonstration are given in Table XI on the following page. No attempt was made by the researcher to categorize these comments due to limited response from the respondents.

Several comments mentioned in Table XI agree with some of the findings of Table X. For example, the "fair" rating on eye contact with the camera in Table X is reinforced by comment number three in Table XI. This failure

to maintain proper eye contact with the camera is characteristic of instructors new to the television media who

TABLE XI

ADDITIONAL COMMENTS ON THE TELEVISED DEMONSTRATION

1. Excessive use of certain phrases, for example "o.k. lets," by the instructor.
2. Excellent presentation.
3. The instructor looked to one side rather frequently which became distracting.
4. Possibly too much breakdown in the demonstration procedure.
5. Too much movement back and forth from the model to the actual meter.
6. Repeated several operating steps and became confused at several points.

persist in watching the television monitor. In comment number four several respondents indicated that there was too much breakdown in the demonstration procedure, but since direct interaction between the instructor and learner in the application step of the procedure was not possible, important points of the televised demonstration had to be presented in clear and simple terms.

Summary

The significant findings of this chapter will be presented in two parts: (1) findings centered around the results of the pretest and post test; (2) important findings of the questionnaire dealing with a critique of the televised demonstration.

Findings of Test Results. The following statements will briefly state the important findings of the test results:

1. In a comparison of mean scores and values of standard deviation obtained from the results of the post test, it is concluded that the experimental and control groups were matched in ability.

2. In a comparison of mean scores of the experimental and control groups on the pretest, it is concluded that both groups were equal in prior knowledge of the lesson content of the demonstrations.

3. In a comparison of mean scores of the experimental and control groups on the post test, it is concluded that the experimental and control groups were equal in the amount of knowledge gained from the conventional and televised demonstrations. These findings would confirm the null hypothesis that there is no difference in the amount learned when taught by televised instruction or by conventional face-to-face instruction.

4. In a comparison of correlated mean scores of the control group on the pretest and post test it is concluded: (1) the control group learned a significant amount from the conventional face-to-face demonstration; (2) the subjects of the control group did not differ significantly from one another in knowledge learned from the demonstration.

5. In a comparison of correlated mean scores of the experimental group on the pretest and post test it is concluded: (1) the experimental group learned a significant amount from the televised demonstration; (2) the subjects of the experimental group did not differ significantly from one another in knowledge learned from the demonstration.

Findings of the Questionnaire. The important findings of the critique questionnaire are as follows:

1. The instructor did not exhibit the symptoms of speaking too rapidly, moving too rapidly, or nervousness which are usually characteristic of instructors new to the television media.

2. The instructor maintained only "fair" eye contact with the television camera.

3. The visual aids designed for viewing on television could be easily seen by the subjects of the experimental group.

4. The actual multimeter was fairly easy to see by television. It might have been possible to present the televised demonstration without the model of the multimeter.

5. The instructional procedure was organised in a clear step-by-step manner.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Rapid advances in industrial technology may seem to be creating serious problems in the field of industrial education. These problems center around a lack of well-trained instructors and lab facilities. If sufficient television facilities were available, both educational and commercial, master teachers well versed in up-to-date techniques could provide a major portion of this instruction to large numbers of students in widely-scattered industrial laboratories. This experiment compared the effectiveness of a televised demonstration with a conventional face-to-face demonstration; it also compared the preparations and problems involved in presenting a demonstration by television with those of a conventional demonstration.

The experimental design of the study utilized the parallel group technique. Two groups, control and experimental, were selected from two intact groups of graduate students in the field of industrial education. Groups were compared on the characteristics of age, overall grade point average, position (all were teachers or students), and their knowledge of the demonstration. The instructor acted as the control on the following variables: (1) lesson content of the demonstration; (2) visual aids used in the demonstrations; (3)tests used to measure achievement of the subjects

involved in the demonstrations.

The researcher learned about the problems of television teaching by operating a television camera for a number of elementary methods teaching demonstrations, and presenting the televised demonstration for the experimental portion of the study. Statistical procedures were used in comparing the mean test scores of the experimental and control groups.

To assess student reactions to the televised demonstration, a critique questionnaire was used to evaluate the instructor, visual aids, and lesson content.

From the findings of the critique of previous research in educational television it is concluded that a major portion of this research is repetitious, in other words, the same kinds of comparisons between conventional and televised instruction have been made many times. It is also concluded that a large portion of the research in televised instruction in the field of industrial education was not evaluated statistically to reinforce stated conclusions.

The findings based on the preparations of the experiment indicate that low-cost industrial type vidicon television cameras and associated electronic equipment were quite adequate for the presentation of the televised demonstration in this study. These findings also stated that a well planned run-down sheet and trial runs are necessary for a successful televised demonstration.

The significant findings of the experimental data obtained from this experiment indicate that the control group and the experimental group were matched in ability and were about equal in prior knowledge of the lesson content of the demonstrations. It is concluded that the experimental group and the control group were equal in the amount of knowledge gained from the conventional and televised demonstrations. Another significant finding is that the instructor of the televised demonstration did not exhibit the usual symptoms of nervousness and the like which are characteristic of instructors new to the television media.

Conclusions of the Study

An analysis of the findings in this study and the experiences of working with the television media were used to formulate the following conclusions:

1. The presentation of the demonstration on trouble-shooting with the Simpson Volt-Ohm-Meter was as effective by the media of closed-circuit television as it was by the conventional face-to-face class demonstration.

2. Both methods of presentation were effective ways of teaching how to use the Simpson Volt-Ohm-Meter.

3. It is possible for inexperienced instructors, after a relative short period of training or experience, to become in general effective instructors using the medium of television.

4. Television teachers need more time to prepare for each demonstration and cannot teach as many classes per day as regular teachers.

5. Closed-Circuit television systems with medium definition (400 lines) vidicon television cameras can be used in televised demonstrations, except in discerning fine details.

6. One of the most difficult problems of teaching a demonstration by television is to maintain proper eye contact with the television camera.

Recommendations of the Study

The following recommendations are presented in an effort to promote additional research and use of televised instruction in the field of industrial education.

1. Criteria for evaluation of the effectiveness of televised instruction in skill-centered learning should be expanded. Televised instruction in this study was evaluated with multiple-choice tests and a questionnaire. Evaluation of televised demonstrations could be expanded by using situation tests with pictorial and sound cues that closely approach real-life situations.

2. As video tape recorders become more economical, the quality of televised demonstrations could be improved. In developing the televised demonstration for this study,

trial-run demonstrations could have been recorded on video tape, edited and used in presenting the actual demonstration.

3. Research should be conducted to determine how interaction between the learner and instructor could be improved in televised demonstrations.

4. Experimental comparisons should be conducted to determine which is more effective, the single-room concept or the multiple-room concept for presenting televised demonstrations.

5. Experimental research should be conducted to determine what closed-circuit television equipment is needed to effectively present televised demonstrations.

BIBLIOGRAPHY

SELECTED BIBLIOGRAPHY

BOOKS

Beam, Robert E. (ed.) Dictionary of Electronic Terms. Sixth Edition. Chicago: Allied Radio Corporation, 1961.

Costello, Lawrence F. and George N. Gordon. Teach With Television. New York: Hastings House, Publishers, 1961.

Educational Television The Next Ten Years. Stanford, California: The Institute for Communication Research, Stanford University, 1962.

Ericson, Emanuel E. Teaching the Industrial Arts. Peoria, Illinois: Chas. A. Bennett Co. Inc., 1960.

Garrett, Henry E. Statistics in Psychology and Education. Fifth Edition. New York: David McKay Co. Inc., (May, 1958).

Good, C. V. and D. E. Scates. Methods of Research. New York: Appleton-Century-Crofts, 1954.

Hubbell, Richard. Television Programming and Production. Second Edition. New York: Rinehart Company, Inc., 1950.

Lewis, Philip. Educational Television Guidebook. New York: McGraw-Hill Book Company, Inc., 1961.

Micheels and Karnes. Measuring Educational Achievement. New York: McGraw-Hill Book Company, Inc., 1950.

Operator's Manual. Simpson Volt-Ohm-Milliammeter 260, Series III, Chicago: Simpson Electric Co., 1959.

Smith, Mary Howard (ed.). Using Television in the Classroom. New York: McGraw-Hill Book Company, 1961.

Tarbet, Donald G. Television and Our Schools. New York: The Ronald Press Company, 1961.

BULLETINS AND PERIODICALS

Barnard, David P. "Audio-Visuals," Industrial Arts and Vocational Education, Vol. 52, No. 1 (January, 1963).

Curry, Estell H. and J. W. Weeks. "Television and Industrial Arts," School Shop, Vol. 22, No. 7 (March, 1963).

Gerrish, Howard H. "Industrial Arts Electronics for Tele-Viewing," Industrial Arts and Vocational Education, Vol. 50, No. 6 (June, 1961).

Parry, Ernest B. "Try Closed-Circuit TV for Better Industrial Education," Industrial Arts and Vocational Education, Vol. 49, No. 10 (December, 1960).

Phares, Gail. "It's What's Up Front That Counts," Industrial Arts and Vocational Education, Vol. 50, No. 2 (February, 1961).

UNPUBLISHED MATERIALS

Campion, Lee E. and Clarice Y. Kelly, "A Directory of Closed-Circuit Television Installations in America With a Pattern of Growth." Occasional Paper No. 10, Studies in the Growth of Instructional Technology, II. Washington: The Department of Audio-Visual Instruction, National Education Association, 1963.

Foshay, Finette P. "Interaction in Learning: Implications for Television." Washington: Division of Audio-Visual Instructional Service, National Education Association, 1959.

Fritz, Martin F. and others (or, et al.) "Survey of Television Utilization in Army Training," Human Engineering Report SpecDevCen 430-01-1, Ames, Iowa: Iowa State College (December, 1952), (Mimeographed).

Greenhill, L. P. "Closed-Circuit Television for Teaching in Colleges and Universities." University Park, Pennsylvania: Pennsylvania State University, 1959. (Mimeographed).

Greenhill, L. P. "New Directions for Communication Research." University Park, Pennsylvania: Pennsylvania State University, 1959. (Mimeographed.)

Kanner, Joseph H. and Wesley P. Marshall. "A Report on Television in Basic Training: The Improvement of Basic Training by Television." Audio Visual Communications Directorate, Office of the Chief Signal Officer (April, 1963). (Mimeographed).

Manchak, Paul J. "Direct-Camera-to-Receiver Television as an Instructional Aid in Industrial Education." Unpublished Master's Thesis, University of Maryland, College Park, 1961.

Rumford, Herbert P. "An Experiment in Teaching Elementary School Methods via Closed Circuit Television." Unpublished Doctor's Dissertation, The University of Colorado, Boulder, 1960.

Sherk, Dennis H. and Luther Kepler, Jr. "Guide for Television Instructors." University Park, Pennsylvania: Pennsylvania State University, 1961.

Tivis, Harold B. "An Established Demonstration Procedure for Presenting a Manipulative Job on an Educational Television Program." Unpublished Master's Thesis, Kansas State College, Pittsburg, Kansas, 1955.

Whitfield, Theron Wayne. "An Investigation of Educational Closed-Circuit Television and its Adaptability to the Industrial Arts Field." Unpublished Master's Thesis, University of Minnesota, Minneapolis, 1958.

APPENDICES

APPENDIX A

PRETEST AND POST TEST FORMS

CRITIQUE QUESTIONNAIRE

PRETEST ON TROUBLESHOOTING WITH A MULTIMETER

Name______________

Date______________

Directions: Score______________

The purpose of this test is to determine your previous knowledge of electricity and the demonstration you will see later. Answer the following questions by placing the appropriate letter in the space provided.

1.___ A multimeter is actually three meters in one and will measure
(a) Voltage and current.
(b) Voltage, current, and watts.
(c) Voltage, current, and amperes.
(d) Voltage, current, and resistance.

2.___ What is the unit of measurement for electrical resistance?
(a) Amperes
(b) Ohms
(c) Voltage
(d) Decibels

3.___ What is the purpose of the range switch on the multimeter?
(a) Zero the meter on the ohms scale.
(b) Change polarity on the meter jacks.
(c) Change the range of the ohms scale.
(d) Change from A.C. to D.C. voltage.

4.___ The first step in zeroing the multimeter on the ohmmeter circuit is...
(a) Insert the test leads in the multimeter.
(b) Adjust the zero ohms knob.
(c) Short the test leads together.
(d) Set the range switch to the Rx1 position.

5.___ Which of the following could you make a continuity test on?
(a) Resistor
(b) Wet cell battery
(c) Fuse
(d) Capacitor

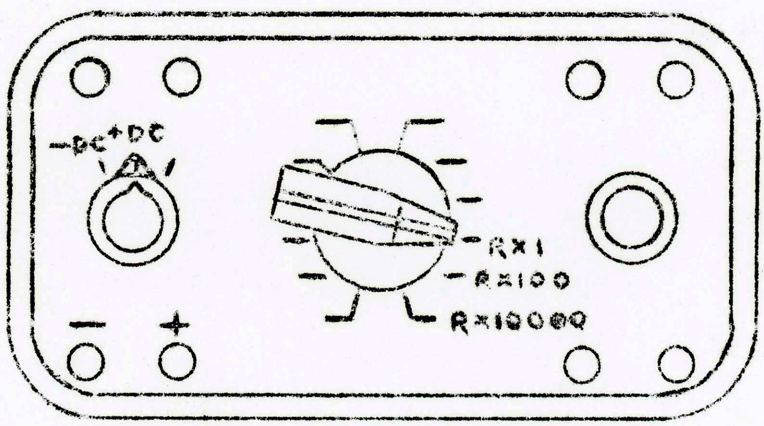
6.___ Which of the following could you make a resistance test on?
(a) Soldering iron
(b) Switch
(c) Fuse
(d) Dry cell battery

7.___ The type of multimeter used in the demonstration was?
(a) EICO
(b) Simpson
(c) General Electric
(d) Allied Radio

8.___ The second step in zeroing the multimeter on the ohmmeter circuit is...
(a) connect the test leads to the multimeter.
(b) adjust the zero ohms knob.
(c) adjust the range switch to the Rxl position.
(d) adjust the selector switch to the A.C. position.

9.___ When zeroing the multimeter on the ohmmeter circuit the function switch should be in what position?
(a) -D.C. position.
(b) -D.C. or +D.C. position.
(c) A.C. position
(d) D.C. position.

10.___ The ordinary range of the ohms scale on the multimeter is...
(a) 0 to 1,000 ohms
(b) 0 to 2,000 ohms
(c) 0 to 3,000 ohms
(d) 0 to 4,000 ohms



Meter
Panel

11.___ In using the multimeter to make a resistance test, the test leads are inserted...
(a) in jacks on the upper right hand side of the meter panel.
(b) in jacks on the lower right hand side of the meter panel.
(c) in jacks on the upper left hand side of the meter panel.
(d) none of these.

12.___ The zero ohms knob is located...
(a) on the left hand side of the meter panel.
(b) on the right hand side of the meter panel.
(c) In the center of the meter panel.

13.___ The function switch is located...
(a) in the center of the meter panel.
(b) on the right hand side of the meter panel.
(c) on the left hand side of the meter panel.

14.___ The range switch is located...
(a) in the center of the meter panel.
(b) on the right hand side of the meter panel.
(c) on the left hand side of the meter panel.
(d) at none of these positions.

15.___ In making a resistance test on the multimeter, the black test lead is inserted in what jack?
(a) - or common.
(b) Output.
(c) -10 A.
(d) 500 V.

16.___ In making a resistance test on the multimeter, the red test lead is inserted in what jack?
(a) Output
(b) - or common
(c) + or positive
(d) 500 V.

17.___ If the range switch was moved from the Rx1 position to the Rx100 position, the range of the multimeter would be extended?
(a) 10 times
(b) 100 times
(c) 1,000 times
(d) 10,000 times

18.___ How much resistance would we be reading if the range switch was located in the Rx100 position and the pointer indicated a reading of 100 ohms on the scale?
(a) 100 ohms
(b) 1,000 ohms
(c) 10,000 ohms
(d) 100,000 ohms

19.___ In making a continuity test on a switch with the multimeter, the pointer would...
(a) move back and forth is the switch were good.
(b) read zero on the ohms scale if the switch was good.
(c) read infinity on the ohms scale if the switch was good.
(d) read infinity on the ohms scale if the switch was intermittent.

20.___ If the multimeter indicates a reading of infinity on the ohms scale where will the pointer be located?
(a) Center of the scale.
(b) Right hand side of the scale.
(c) Left hand side of the scale.
(d) None of these.

POST-TEST ON TROUBLESHOOTING WITH A MULTIMETER

Name_______________

Date_______________

Directions: Score_______________

Answer the following questions by placing the appropriate letter in the space provided.

1.___ The first step in zeroing the multimeter on the ohmmeter circuit is?
(a) Insert the test leads in the multimeter.
(b) Adjust the zero ohms knob.
(c) Short the test leads together.
(d) Set the range switch to the Rxl position.

2.___ What is the purpose of the range switch on the multimeter?
(a) Zero the meter on the ohms scale.
(b) Change polarity on the meter jacks.
(c) Change the range of the ohms scale.
(d) Change from A.C. to D.C. voltage.

3.___ The type of multimeter used in the demonstration was?
(a) EICO
(b) Simpson
(c) General Electric
(d) Allied Radio

4.___ A multimeter is actually three meters in one and will measure...
(a) voltage and current.
(b) voltage, current, and watts.
(c) voltage, current, and amperes.
(d) voltage, current, and resistance.

5.___ Which of the following could you make a resistance test on?
(a) Soldering iron
(b) Switch
(c) Fuse
(d) Dry cell battery

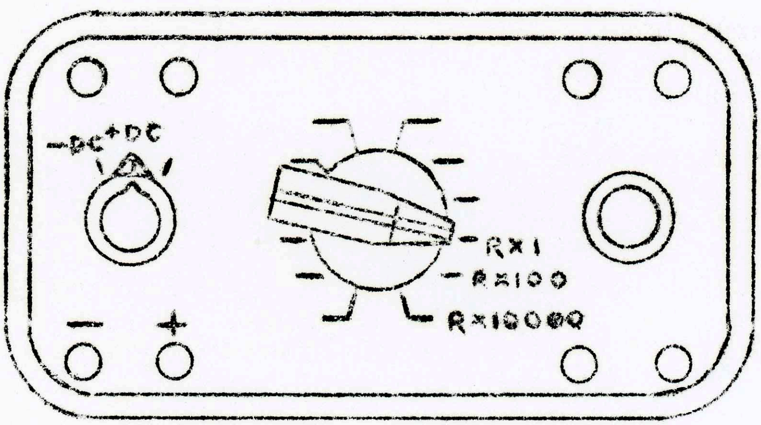
6.___ What is the unit of measurement for electrical resistance?
(a) Amperes
(b) Ohms
(c) Voltage
(d) Decibels

7.___ Which of the following could you make a continuity test on?
(a) Resistor
(b) Wet cell battery
(c) Fuse
(d) Capacitor

8.___ The second step in zeroing the multimeter on the ohmmeter circuit is...
(a) connect the test leads to the multimeter.
(b) adjust the zero ohms knob.
(c) adjust the range switch to the Rx1 position.
(d) adjust the selector switch to the A.C. position.

9.___ When zeroing the multimeter on the ohmmeter circuit the function switch should be in what position?
(a) -D.C. position.
(b) -D.C. or +D.C. position.
(c) A.C. position
(d) D.C. position.

10.___ The ordinary range of the ohms scale on the multimeter is...
(a) 0 to 1,000 ohms
(b) 0 to 2,000 ohms
(c) 0 to 3,000 ohms
(d) 0 to 4,000 ohms



Meter Panel

11.___ In using the multimeter to make a resistance test, the test leads are inserted...
(a) in jacks on the upper right hand side of the meter panel.
(b) in jacks on the lower right hand side of the meter panel.
(c) in jacks on the upper left hand side of the meter panel.
(d) none of these.

12.___ The zero ohms knob is located...
(a) on the left hand side of the meter panel.
(b) on the right hand side of the meter panel.
(c) In the center of the meter panel.

13.___ The function switch is located...
(a) in the center of the meter panel.
(b) on the right hand side of the meter panel.
(c) on the left hand side of the meter panel.

14.___ The range switch is located...
(a) in the center of the meter panel.
(b) on the right hand side of the meter panel.
(c) on the left hand side of the meter panel.
(d) at none of these positions.

15.___ In making a resistance test on the multimeter, the black test lead is inserted in what jack?
(a) - or common.
(b) Output.
(c) -10 A.
(d) 500 V.

16.___ In making a resistance test on the multimeter, the red test lead is inserted in what jack?
(a) Output
(b) - or common
(c) + or positive
(d) 500 V.

17.___ If the range switch was moved from the Rx1 position to the Rx100 position, the range of the multimeter would be extended?
(a) 10 times
(b) 100 times
(c) 1,000 times
(d) 10,000 times

18.___ How much resistance would we be reading if the range switch was located in the Rx100 position and the pointer indicated a reading of 100 ohms on the scale?
(a) 100 ohms
(b) 1,000 ohms
(c) 10,000 ohms
(d) 100,000 ohms

19.___ In making a continuity test on a switch with the multimeter, the pointer would...
(a) move back and forth is the switch were good.
(b) read zero on the ohms scale if the switch was good.
(c) read infinity on the ohms scale if the switch was good.
(d) read infinity on the ohms scale if the switch was intermittent.

20.___ If the multimeter indicates a reading of infinity on the ohms scale where will the pointer be located?
(a) Center of the scale.
(b) Right hand side of the scale.
(c) Left hand side of the scale.
(d) None of these.

CRITIQUE OF THE CLOSED-CIRCUIT TELEVISION DEMONSTRATION

1. Check items that apply in evaluation of the instructor.

   a. Rate of speaking.
      (1) Too fast. . . . . ____
      (2) About right . . . . ____
      (3) Too slow. . . . . ____
   b. Clearity of speech
      (1) Good. . . . . ____
      (2) Fair. . . . . ____
      (3) Poor. . . . . ____
   c. Body movement
      (1) Too rapid . . . . ____
      (2) Allright. . . . . ____
      (3) Distracting . . . . ____
   d. Eye contact with the camera
      (1) Good. . . . . ____
      (2) Fair. . . . . ____
      (3) Poor. . . . . ____
   e. Composure
      (1) Relaxed . . . . ____
      (2) Nervous . . . . ____

2. Check the items that apply in evaluation of the visual aids.

   a. Charts and model of the meter.
      (1) Easy to see . . . . ____
      (2) Fairly easy to see. . . . ____
      (3) Hard to see . . . . ____
   b. The actual multimeter
      (1) Easy to see . . . . ____
      (2) Fairly easy to see. . . . ____
      (3) Hard to see . . . . ____

3. Check items that apply in evaluation of the lesson content of the demonstration.

   a. Procedure
      (1) Clear step-by-step. . . . ____
      (2) Fairly well organized . . ____
      (3) Not well organized. . . . ____
   b. Length of the demonstration
      (1) Too long. . . . . ____
      (2) About right . . . . ____
      (3) Too short . . . . ____

4. Additional comments ____

____

APPENDIX B

TV SCRIPT AND FLOOR PLAN

KANSAS STATE COLLEGE OF PITTSBURG

INSTRUCTIONAL TELEVISION RUNDOWN SHEET

DATE: NAME:

SHOW TITLE: Troubleshooting with a Multimeter DIRECTOR:

VIDIO	AUDIO
1. SHOOT TITLE.	I. <u>OBJECTIVE OF THE DEMONSTRATION</u>:
2. SHOOT INSTRUCTOR HEAD AND SHOULDERS. 3. REMOVE TITLE FROM STAND.	IN THIS DEMONSTRATION YOU WILL LEARN HOW TO USE THE MULTIMETER IN TROUBLESHOOTING ELECTRICAL DEVICES AND VARIOUS CIRCUITS. YOU WILL LEARN HOW TO PERFORM A CONTINUITY CHECK AND A RESISTANCE CHECK. BEFORE WE GO ANY FARTHER I WANT TO SHOW YOU WHAT TOOLS AND MATERIALS WILL BE USED IN THE DEMONSTRATION.
	II. <u>TOOLS AND MATERIALS</u>:
4. MEDIUM SHOT OF INSTRUCTOR AS HE POINTS OUT TOOLS.	1. VISUAL AID OF MULTIMETER 2. SIMPSON MULTIMETER 3. TEST LEADS 4. CONTINUITY TESTOR 5. ITEMS TO BE TESTED: a. Switch b. FUSES c. SOLDERING IRON d. CARBON RESISTOR
	III. <u>PREPARATION</u>:
5. PAN SHOT OF SET.	1. WHAT IS A MULTIMETER?
6. ZOOM IN ON INSTR. AND CHART.	2. WHAT IS RESISTANCE? 3. WHAT IS A CONTINUITY TEST? 4. WHAT IS A RESISTANCE TEST? 5. THESE TESTS ARE TO BE MADE WITH THE POWER TURNED OFF. EXAMPLE: BOY WORKING WITH A RADIO

VIDIO	AUDIO
7. FOLLOW INSTRUCTOR TO THE LAB TABLE AND ZOOM IN ON THE CONTINUITY TESTOR.	6. START OFF BY MAKING CONTINUITY TEST ON A FUSE. IV. <u>PRESENTATION:</u>
8. ZOOM IN ON THE VISUAL AID	1. EXPLAIN KNOBS AND SWITCHES ON THE MULTIMETER. (VISUAL AID) 2. EXPLAIN THE METER SCALE. RANGE a. 0 to 2,000 OHMS (INFINITY) RX1 POSITION b. 0 to 200,000 RX100 3. ZEROING THE OHMMETER CIRCUIT. REASON. ACCURACY. CHANGE RANGE DIFFERENT CIRCUITS. 4. PROCEDURE. a. ADJUST SWITCHES (1) FUNCTION -D.C. OR D.C. POSITION (2) RANGE RX1 POSITION
9. ZOOM IN ON THE REAL METER.	b. INSERT LEADS (1) RED POSITIVE JACK (2) BLACK COMMON OR (3) REASON WON'T DAMAGE METER ON VOLTAGE TEST. c. CONNECT LEADS TOGETHER. d. ADJUST ZERO OHMS CONTROL. OBSERVE POINTER ZERO ON OHMS SCALE. 5. TEST A SWITCH FOR CONTINUITY. POINTER WILL MOVE WITH THE CLICK OF THE SWITCH. GOOD.

VIDIO	AUDIO
	6. TEST BUGGED FUSE FOR CONTINUITY. METER WILL READ INFINITY. FUSE BAD.
10. ZOOM IN ON THE CONTINUITY TESTOR.	7. TEST BUGGED FUSE ON CONTINUITY TESTOR.
11. ZOOM IN ON THE ACTUAL METER.	8. TEST THE ELEMENT OF A SOLDERING IRON FOR RESISTANCE.
12. ZOOM TO AID TO SHOW RX100 POSITION.	a. SET THE RANGE SWITCH TO THE RX100 REASON MORE ACCURATE READING.
	b. ZERO METER
	c. CONNECT LEADS TO PLUG.
	d. TAKE READING. OHMS SCALE.
13. ZOOM TO THE AID.	e. SHOW ON VISUAL AID.
	V. <u>APPLICATION</u>:
14. SHOT OF CHART ON ZEROING THE METER.	1. REVIEW PROCEDURE FOR ZEROING THE METER.
	VI. <u>SUMMARY</u>:
15. SHOOT INSTR. HEAD AND SHOULDERS.	IT IS HOPED THAT THIS DEMONSTRATION HAS GIVEN YOU AN INSIGHT INTO THE CONTINUITY AND RESISTANCE TEST METHOD OF TROUBLESHOOTING.
	I WANT TO THANK YOU FOR YOUR COOPERATION AND HELP.
	DR. PERRY WOULD YOU PASS OUT THE POST-TEST. ON THE LAST PAGE IS A CRITIQUE SHEET ON THE DEMONSTRATION. WOULD YOU PLEASE FILL THIS OUT.
16. ZOOM IN ON THE AID WHILE THE STUDENTS TAKE THE TEST.	THE CAMERA WILL REMAIN ON THE VISUAL AID DURING THE TEST, WHICH MAY HELP YOU IN ANSWERING SOME OF THE QUESTIONS ON THE TEST.

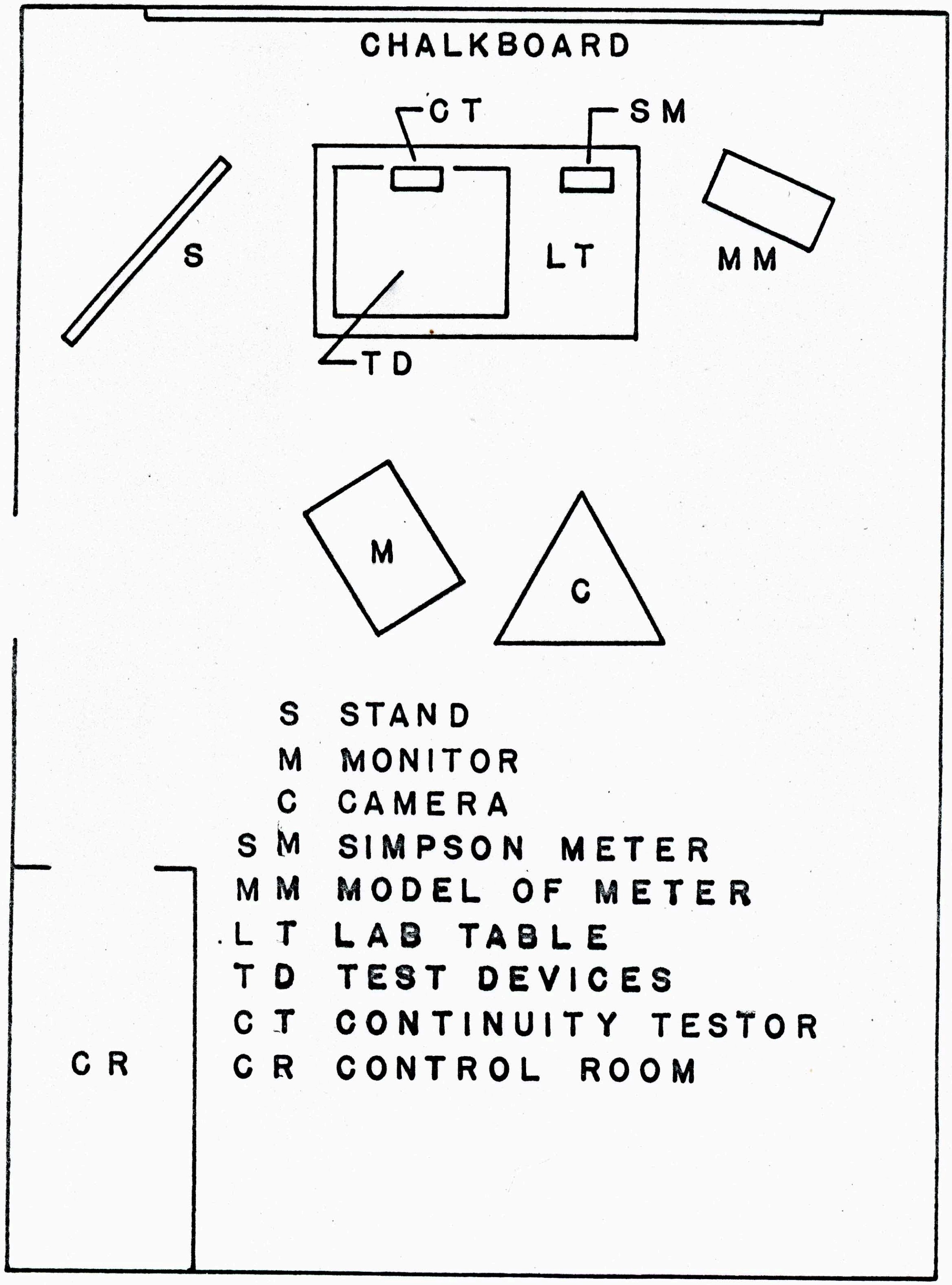
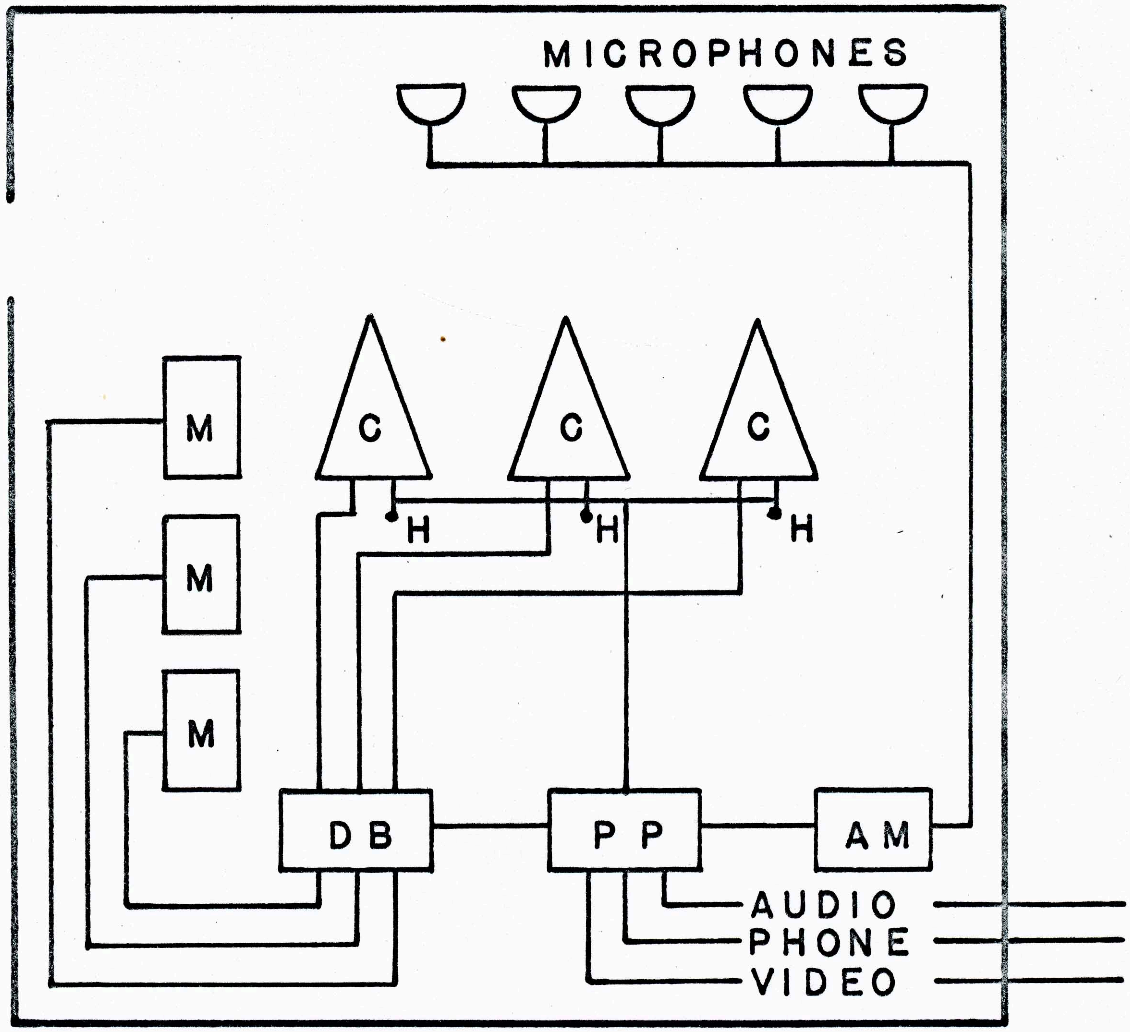


FIGURE 3

FLOOR PLAN FOR THE TELEVISED DEMONSTRATION



C CAMERA
M MONITOR
PP PATCH PANEL
H HEADSET

DB DISTRIBUTION BOX
AM AUDIO MIXER AND AMPLIFIER

FIGURE 4

WIRING DIAGRAM OF THE TV DEMONSTRATION ROOM