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THE IMPROVEMENT OF TELEVISION INSTRUCTION IN ARMY TRAINING: APP--ETC(U)
AUG 57 J KANNER, O DESIDERATO, G WISCHNER DA-49-106-QM-1

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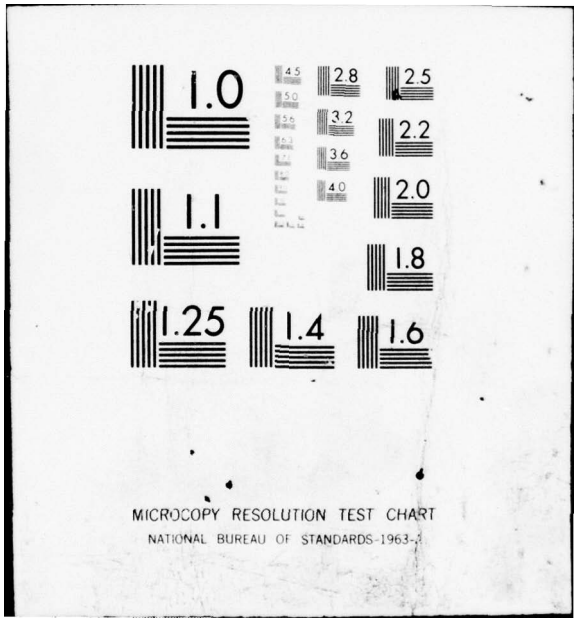
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HumRRO

LEVEL II

Training Methods Division

The George Washington University
HUMAN RESOURCES RESEARCH OFFICE
operating under contract with
THE DEPARTMENT OF THE ARMY

Conclusions stated herein do not necessarily represent the official opinion or policy of the Department of the Army.

(1)

Task: TV-2

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STAFF MEMORANDUM

(6) THE IMPROVEMENT OF TELEVISION INSTRUCTION IN ARMY TRAINING:

Application to Selected Hours in Basic Radio Circuits,

(11) August ~~1st~~ 1957

Staff
Training Methods Division

(12) 32 p.

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operating under contract with
The Department of the Army

CONTENTS

COMPOSITION OF RESEARCH TEAM

The original staff for the present study included Dr. Joseph Kanner, Task Leader, Dr. Otello Desiderato and Dr. Richard P. Runyon. This group set up the original studies in the field, gathered all the data and conducted some analysis. The study was continued by Dr. George Wischner, Task Leader, Dr. Ivan Scheier, and Mrs. Sylvia Hoke. This team modified and extended the original analysis. Drs. Wischner and Scheier wrote a draft report as did Drs. Kanner, Desiderato and Runyon. Mr. Roy J. Jones and Mr. Robert T. Root reanalyzed the data and drawing freely upon the documents mentioned above prepared the present report.

BRIEF

This study was initiated by the Human Resources Research Office at the request of the Office, Chief of Army Field Forces (now United States Continental Army Command). This report describes a series of pilot studies designed to investigate (1) procedures for improving television instruction, (2) the use of television techniques for reducing instructional time, (3) problems involved in the training of instructors for teaching by television, and (4) whether lower cost television equipment produced measurable differences in the amount of student learning.

This series of experiments was carried out with 683 students enrolled in the Field Radio Repair course at the Southeastern Signal School, Fort Gordon, Georgia. The students participating in this study were students in the second and fifth weeks of the course which was of 26 weeks duration.

Four hours of instruction were selected for study upon the recommendation of military personnel who considered them to be critical. They included: Capacitive Circuits, Inductive Circuits, Series Resonance, and Tank Circuits.

A total of 31 different classes were employed in the present experiment. The number of experimental groups employed for a particular objective varied. In some cases there were four to five different TV versions of the same hour of instruction. In addition to the experimental groups, data were also gathered for groups receiving regular classroom instruction. These groups served as the baseline against which the effectiveness of various modifications in television was compared.

Multiple-choice tests based on the official lesson outlines for regular instruction were administered to the students immediately following the completion of the instructional hour.

The results bearing on the four major objectives of this exploratory study show that:

(1) Although the differences are not all reliable, in six instances out of seven, "improved" television instruction was superior (i.e., higher mean scores) to "unimproved" regular instruction.

(2) When emphasis was placed on time reduction per se, the results were inconclusive. It appears, however, that time reduction is somehow related to subject-matter. The mean performance scores

of the experimental groups were higher on Inductive and Tank Circuits than the mean performance scores of the regular instruction group, while with Series Resonance the mean score of the regular instruction group was higher than those of the experimental groups.

(3) Groups taught by inexperienced instructors, with about two hours training and with use of a prepared script and teleprompter, achieved relatively as well as did groups taught by experienced instructor personnel.

(4) Only chance differences were found between low-cost camera equipment and moderate-cost camera equipment, indicating that camera equipment had little influence upon proficiency scores.

INTRODUCTION

This exploratory study was initiated by the Human Resources Research Office at the request of the Office, Chief of Army Field Forces (now United States Continental Army Command). Results of a previous HumRRO study (2) as well as other studies in the area of educational television (3, 4) have indicated that television is at least as effective as regular classroom instruction. One characteristic of these previous studies is especially noteworthy: comparison of television and standard classroom instruction was made under controlled or matched conditions. The result then was a comparison of two instructional methods--television and regular classroom instruction--with the television classes being exposed to approximately the same instructional presentation as the standard classes. This type of experimental design prohibited the researcher from selective modification of ongoing instruction for television adaptation purposes. The conditions of control imposed by such a design prevented the drawing of any conclusions regarding the effectiveness of the instruction per se. Maximal exploitation of television for instructional purposes was not considered an objective of previous research.

It is apparent that maximum utilization of television should extend beyond the procedure of simply putting on a screen whatever occurs in a regular classroom situation. Moreover, teaching methods appropriate for regular instruction may require considerable modification in adapting the instructional content for television production.

THE PROBLEM

Operational Problem

This study represents the third phase of a systematic program of research on the teaching effectiveness of television instruction. The original OCAFF (CONARC) requirement was concerned with an evaluation of the utilization of television for Army training purposes.

Phase I of this program of research was conducted by the Special Devices Center and published as Technical Report SDC 530-01-1, Survey of Television Utilization in Army Training (1).

The results of Phase II are reported in Technical Report No. 14, Human Resources Research Office, Television in Army Training: Evaluation of Television in Army Basic Training (2). While this study was

restricted to Army basic trainees, it generated a number of promising hypotheses on the use of television for other types of Army training. In a letter from the Office, Chief of Army Field Forces, to Assistant Chief of Staff, G-3, dated 15 June 1953, the problem was formulated as follows: "While there is limited evidence that television is a successful training medium, such evidence is not sufficient to justify the mass application of the medium in the Army without further practical test and trial . . . Emphasis should be given to . . . 'Evaluation of learning' with special attention to learning in television instruction compared with learning under matched conditions of usual instruction techniques."

In November 1953, HumRRO submitted a research proposal pertaining to the continued exploration in the area of television instruction. In December 1953, OCAFF recommended an extension of the evaluation of television in accordance with the research plan submitted.

Research Problem

The purpose of this exploratory study was to investigate the potentialities of television instruction per se. The emphasis was unlike that of the previous HumRRO study (2) which concerned itself with a comparison of television and regular instruction under matched conditions. Specifically the objectives of this research were:

1) To explore the effects on trainee learning produced by successive modifications of television presentations as compared with regular instruction.

2) To explore the effects on trainee learning produced by a reduction in time normally required for a given unit of instruction.

3) To compare the television teaching effectiveness of instructors differing in amount of teaching experience.

4) To evaluate the effects upon trainee learning using moderate and low cost television equipment.

DESCRIPTION OF THE RESEARCH

Research Method

The series of experiments on which the findings of this study are based were carried out with enlisted students of The Southeastern Signal School, Fort Gordon, Georgia. The research was conducted from 1 April through 30 June, 1954. The trainees studied were enrolled in the Field Radio Repair Course and ranged in intelligence from normal to superior with the average student in the upper 20 per cent of the Army population. The Aptitude Area IX scores were then used as a measure of electronic aptitude to select students for the course. (The Area IX score is a composite score of Arithmetic Reasoning, Reading Vocabulary, Electronic Information and Radio Information scores.) The particular groups participating in the studies were students in the second and fifth weeks of the course which was of 26 weeks' duration. A total of 683 students participated in the studies. They were grouped in 31 different classes. Some classes were used in more than one aspect of the research.

In addition to the fixed closed-circuit facilities provided by the television branch of the school, additional technical support was provided by the Mobile Field Unit of the Television Division, Army Pictorial Center, New York. The camera equipment employed was of the commercial (image-orthicon) type, and for one research objective, a two-camera lower cost (vidicon) camera chain was procured, installed, and operated by the same technical personnel.

Selection of Subject-Matters

The selection of subject-matters reflected in part the need to investigate the effectiveness of television instruction with more complex, technical material than that used in the previous HumRRO study. Investigation of the effectiveness of television in teaching fairly abstract, conceptual content could lead to hypotheses which would apply to a wider range of military instruction.

Previous research had indicated that television instruction was more effective with certain types of subject matters than with others (2, 3, 4). The superiority of televised over regular classroom instruction was especially marked when applied to the teaching of materials requiring an understanding of relationships among small moving parts, acquisition of motor skills in manipulating pieces of equipment, paired-associate learning and, to a smaller degree, recognition of objects. It was considered highly desirable, therefore, to work with subject matters of a type which had not been shown to yield advantages for television instruction.

The area of selection was narrowed down to the Field Radio Repair Course for enlisted men at The Southeastern Signal School. From the introductory "Principles of Electricity" phase of this 26 week course, four hours of instruction were selected which appeared to satisfy the requirements and which best approximated the general objectives of the study. These were Inductive Circuits, Capacitive Circuits, Series Resonance and Tank Circuits. Inductive and Capacitive Circuits were always taught in the second week of the course; Series Resonance and Tank Circuits always came in the fifth week.

Observation of conventional classroom presentation indicated these hours of instruction would provide a challenging test of television's instructional effectiveness. The four hours were concerned with the characteristics of inductors and capacitors; phase relationships among current, voltage, and counter-electromotive force when direct, alternating, or pulsating direct current was fed into the circuits. The teaching content was mainly of a verbal theoretical nature, presented in the lecture and blackboard manner. No other training aids or other visual materials were employed.

These four hours were singled out by course instructors as being difficult to teach. This was further evidenced by the large number of trainees who had to repeat the courses. Moreover, mastery of the concepts contained within these four units of instruction was considered critical for the assimilation of subsequent instruction in the remainder of the course.

Procedure

A series of television presentations was constructed for each of the four hours of instruction. Comparisons were to be made among such television presentations and the conventional classroom presentations with respect to teaching effectiveness (as measured by trainee test scores) as it varied (1) with modifications in the television presentations, (2) with attempts at instruction-time reduction, (3) with changes in the nature of the camera equipment used, and (4) with differences in teaching experience among instructors.

The general procedure was to measure the teaching effectiveness of conventional classroom instruction for each of the four hours, as it was being taught at the school. Objective tests described below were prepared and administered immediately after each of the selected hours. These test scores provided both a base line measure for later comparisons and a measure of ongoing conventional instruction before the instructor's teaching ability could be influenced by his television training.

The next step was to adapt each hour for television instruction in accordance with the objectives of this research.

Experimental Groups

During the period of the research a new group of from forty to ninety students began the six month Field Radio Repair Course each week. The students were equally divided among two or three different classes for regular instruction, depending on the number of incoming students. Once assigned to a class the students remained with that class throughout the course. All classes starting the course at the same time normally received the same unit of instruction at the same time, although each class was taught by a different instructor. The classes used in these studies were assigned an experimental group number.

Table 1 summarizes the various experimental groups and the conditions under which they participated in the present series of studies. In this table, numbers refer to intact groups of students. It may be noted that the same group may appear more than once. For example, class 20 was used with all four subject-matters. Each class, however, was used only once for any one subject-matter.

The columns designated by Roman numerals I through V refer to the principal variations considered in this series of studies; Columns II through V refer specifically to television instruction.

Column I (Regular Instruction). The groups listed in this column received the regular classroom instruction and serve as a baseline against which the effectiveness of various modifications in television instruction can be compared.

Column II (Script Improvement Emphasis). The different groups in each row in the column received different versions of television instruction in each of the four subject matters. TV-1 always refers to the first television production, with changes in numerals indicating successive versions of the TV production. In some instances the same production was tried with different classes to increase the number of cases. Thus, 20 and 21 both received TV-3 in Capacitive Circuits.

Column III (Time Reduction Emphasis). These groups were used primarily in exploring the effects of the reduction of instruction time. This was attempted almost exclusively with Series Resonance and Tank Circuits, although a later class (25) was used for this

Table 1. Tabular Presentation of Research Design

Subject Matter	Regular Instruction		Television Instruction			
	Column I	Column II Television Production Variation-Script Improvement Emphasis	Column III Television Production Variation-Time Reduction Emphasis	Column IV Instructor Experience	Column V Low-Cost Camera Equipment
Capacitive Circuits	16 17	TV1 18, TV2 19, TV3 20, TV3 21		TV3 "Partly New" 23, TV3 "All New" 25	TV3 24
Inductive Circuits	16 17	TV1 18, TV2 19, TV3 20, TV4 21	TV5 25	TV5 "Partly New" 22, TV5 "All New" 23	TV4 24
Series Resonance	17 18		TV1 19, TV2 20, TV3 21	TV3 "All New" 22	
Tank Circuits	17 18		TV1 19, TV2 20, TV2 22	TV2 "All New" 21	

purpose with the Inductive Circuit hour of instruction. In a general sense, the concern here is with television production variations, but variation in this case was oriented primarily toward cutting instruction time.

Column IV (Instructor Experience). These groups were given the indicated television instruction with either a "partly new" or an "all new" instructor. The former was a man who had taught other subjects in the radio repair course but had never taught this specific subject-matter before. The "all new" instructor was a person who had no previous teaching experience of any kind. The groups in this column may be contrasted with those in Column II where TV instruction was given by the experienced instructor who normally conducted the regular hour of instruction.

Column V (Low-cost Camera Equipment). These groups were given the indicated television version, the only difference being the use of low-cost cameras instead of the moderate-cost cameras usually employed. The script and instructor were the same as those for the corresponding variations in Column II.

The comparisons in the present series of studies were among different classes for the same subject-matter. Television instruction in one subject-matter is not to be compared with that in another.

The effectiveness of different television versions of the same subject-matter can be assessed by comparing groups in Column II with one another. For example, we may compare the performance of groups 18 and 19 to determine the relative effectiveness of the various television productions on Capacitive Circuits.

The effects of instructor experience can be evaluated by comparing groups in Column IV with those in Column III receiving the same television script. We may compare, for example, 21 and 22 as both received TV-3 on Series Resonance. They differ in that 22 had a completely inexperienced (or "all new") instructor, while 21 had an experienced instructor who regularly taught the hour.

By comparing the group in Column V (group 24) with that in II receiving the same TV instruction (group 21) the effects of differences in camera equipment can be assessed.

In order to determine teaching effectiveness for the four subject-matters, each of the TV variations may be compared with the classes receiving regular instruction (Column I), using the regular instruction classes as the baseline.

Instructors

All instruction for the four selected hours was given by non-commissioned officers who were assigned as permanent instructors in the Field Radio Repair Course--with one exception. One enlisted man who had never had teaching experience, training in instructional methods, or experience in public speaking was trained to present televised instruction in accordance with the research objective of investigating minimal instructor requirements for television instruction.

The other instructors were selected as follows: the most effective instructor already teaching both Inductive and Capacitive Circuits was selected on the basis of superior achievement test scores produced by his group of trainees. The tests were administered immediately following the two lessons presented in the unmodified regular classroom manner. The same procedure was followed in selecting the instructor for Series Resonance and Tank Circuits. In cases where no significant differences were found among the scores of trainees exposed to several instructors, all instructors were interviewed by television production personnel who made the final selection on the basis of physical appearance, clarity of speech and estimated ability to follow production requirements with flexibility and cooperation. For any given hour of instruction, the same instructor was used in comparing the teaching effectiveness of improved or "compressed" television presentations against the regular instruction baseline, or in comparing the effectiveness of standard image-orthicon camera against low-cost equipment.

Comparisons in which different instructors were employed were those in which differences in the amount of teaching experience were studied. In this case, the instructor who regularly taught Inductive and Capacitive Circuits and who had presented these hours on television was now trained to present televised versions of Series Resonance and Tank Circuits. Comparisons were made among achievement scores produced by trainees exposed to this "part new" instructor and scores produced by trainees exposed to the same two hours taught by an "experienced" instructor.

In this phase of the study, the completely inexperienced instructor ("all new") was trained to present three different hours of televised instruction--Inductive Circuits, Series Resonance, and Tank Circuits. The performance of his trainees was compared with that of the experienced instructor's students for all three hours and with the part-new instructor's groups on Capacitive Circuits.

Test Construction, Administration and Scoring

A written, four-option, multiple-choice test, based on the official lesson plan objectives, was constructed for each of the four subjects. An electronics specialist with considerable experience in curriculum planning assisted in constructing the items and in examining them for accuracy, clarity and pertinence to the lesson plan objectives. Items were selected with the aim of measuring amount of information acquired, understanding of concepts, ability to transfer concepts acquired to the solution of typical problems and ability to reason deductively using information acquired during the instructional presentation. Each test also included several "picture-type" items in the form of schematic diagrams of basic circuits, in which trainees were asked to deduce such conclusions as the direction of current flow.

Prior to their administration in the study proper, each test was extensively pre-tested on samples of trainees similar to those used in the research. As a result of this procedure, a large number of items were eliminated or revised on the basis of difficulty, internal consistency and/or containing poor distractors. The final tests consisted of 15 to 18 items each.

The tests were administered immediately after each hourly unit of television or regular instruction. Trainees were told to guess if they did not know the answer. A period of fifteen minutes was found to be adequate for the completion of the tests. Each test was introduced by a standard set of instructions which appeared at the beginning of the tests but which was also read to the trainees by the instructor who had just terminated the televised or regular classroom presentation.

A questionnaire was constructed to obtain information from the trainees on their reactions to the television and regular instruction received. It was administered to a number of trainee groups immediately after the achievement tests had been completed. Tabulated responses provided a valuable source of information regarding parts of the lesson which needed better or more extended coverage, objectionable or distracting instructor mannerisms and ineffective production procedures. In short, the questionnaires fulfilled a feed-back function by providing information that was useful in preparing and revising succeeding televised presentations.

Immediately after their completion the achievement tests were scored at least twice. Item analyses were conducted for each experimental group. This procedure provided an empirical basis for evaluating the weaknesses of a given televised presentation as well as a sound basis for revisions of subsequent scripts. In practice, the procedure of scoring and analysis was completed several hours after the termination of a televised unit of instruction; information derived therefrom was collated and discussed with the instructional, production and research staff; scripts and presentations were revised and rehearsed; and the modified presentation was ready for transmission the second day after the preceding version.

Preparation of Television Instruction

The objectives of the study called for the modification of four selected hours of instruction, as required for television adaptation purposes, with the aim of increasing teaching effectiveness and reducing training time. While the instructional content could be modified or juxtaposed in any way to meet television adaptation requirements, the lesson plan objectives for each of the hours were not to be altered. Moreover, no change was permitted in the scheduled occurrence of the four hours in the course curriculum--two hours always appeared in the second week, the other two in the fifth week.

As indicated above, the content of the televised presentations originated from official lesson plans for the selected hours as well as from critical analyses of tests administered to trainees exposed to regular instruction. Scripts were constructed by research personnel in close harmony with an electronics training specialist and members of the television production staff.

Observation of regular classroom instruction had suggested that a number of the questions asked by trainees bore little relevance to the ongoing instructional topic and contributed little to the general understanding of other class members. Therefore, no provision was made for such "discussion." Instead, a procedure incorporating a question and answer period, which had been previously found successful, was followed: a number of regular instruction classes were closely observed, during which a careful count was made of the kind of questions that were asked by trainees together with estimates of their frequency. After discarding questions of obvious irrelevance, the remaining questions were ranked in order of frequency of occurrence. Such questions were then incorporated into the television scripts in a rhetorical manner, each being emphasized in accordance with its ranked frequency. In this way, the instructor himself would pose questions to his television

audience, would urge them to call out or write down their answers and then would present the answers verbally or on the blackboard.

One of the recurrent characteristics of the regular instruction presentations, observed prior to the commencement of the study, was the considerable amount of repetition of a number of teaching points on the part of the instructors. In preparing the first television presentation for each hour, the procedure was to reduce drastically the amount of repetition of topical material which the pre-tests indicated had been well learned even before the trainees received the specified hours of instruction. In the first television format, all important points were covered once in the body of the instruction and repeated once again in the terminal summary. Only when test results obtained after the television presentation indicated the need for strengthening a segment of the instruction was the amount of repetition increased. This procedure represents an attempt, therefore, to replace repetition with a more systematic, data-based method of selective reinforcement of weak points in the instruction.

A major characteristic of the approach in preparing the television presentations was the attempt to interweave relevant verbal and visual information so that each complemented and reinforced the other. Emphasis was always focused on placing the instructor's voice against a background of charts, drawings or other training aids which graphically emphasized, clarified, or illustrated the instructor's verbal material. It was felt that the advantage of television in selectively integrating a host of audio-visual elements into a unified, uninterrupted sequence should not be neglected. Such techniques as the split-screen or super-imposed presentation of visual elements in temporal and spatial contiguity would be difficult or uneconomical to achieve in conventional instruction. Equally important, the televised presentation was planned in such a way that every step of the demonstrations, for example, would appear on the screen without any time being consumed by the instructor in setting up equipment, writing on the blackboard, walking to and away from equipment, etc. It was felt that, moreover, these procedures would also have the advantage of eliminating distractions resulting from unnecessary movements on the part of the instructor.

In the first television presentations, written participation was employed. Later, when reduction in training time became the major objective, verbal participation was employed, wherein trainees verbally practiced material, coached by the instructor on the screen. Participation further extended control over the relevant material which the trainee was taught. Very often, when reducing the amount of repetition, participation was substituted. That is, the instructor's verbal repetition of a point was replaced by his asking the trainee to write down or call out the information.

A source of training time reduction and possible teaching improvement lay in the elimination of analogies. All analogies were replaced by explanations in operational terms, each concept being defined denotatively by reference, for example, to observable changes in current flow as measured by meter readings, current variations in actual circuits, etc.

The task of writing the television scripts so that they were as clear and simple as possible was a continuous one. This meant substituting familiar words for less common, technical terms, inserting suitable transitions in passing from topic to topic, and rearrangement of teaching points in a more logical and understandable order.

Prompting Equipment

A prompting device was installed at eye level directly above the lens turret of each television camera. As the instructor read from it, the prompting device automatically exposed five or six lines of the script through a window aperture. The speed with which the prompting devices exposed the lines of script was simultaneously remote-controlled for all three prompters.

With use of the cueing equipment, the problem of instructor variability was considerably reduced. During the three month course of the study, there was not a single instance of "stage fright" or serious departure from the prepared teaching materials. A constancy of presentation almost approaching that afforded by motion pictures was achieved. At the same time, unlike films, the cueing device permitted rapid changes in content, sequence and method of instruction, as required, immediately after analysis of test scores following each presentation.

The instructors adjusted to the cueing equipment in two to four hours, thus effecting a marked reduction in ordinary rehearsal time. (In the earlier HumRRO study rehearsal time averaged 10 hours without such equipment.) This procedure also resulted in a reduction in stress upon the instructor and upon technical and production personnel. Changes in script could be incorporated into a revised television presentation quite successfully with this technique.

Instructors, regardless of the amount of teaching experience, rapidly adjusted to television teaching. A source of encouragement to the instructors was the marked improvement effected even by small units of rehearsal time.

ANALYSIS OF FINDINGS

The findings bearing on each of the four major objectives of the present series of experiments will be considered in the order in which the objectives were originally stated. As previously mentioned, trainees are assigned to the Field Radio Repair Course on the basis of aptitude area IX scores. Listed below in Table 2 are the summary statistics of Aptitude Area IX scores for all the groups used in this study. It should be noted that the range of the mean scores for these groups is from 115.98 (Group 17) to 123.62 (Group 25). The total number of students participating in this study was 683, but Aptitude Area IX information was not available on 29 of them. Although sizable relationships were found between these scores and performance on the discrete hours of instruction under investigation, (r's from 0.62 to 0.76), Aptitude Area IX could not be used as a control variable for a covariance analysis because the data do not meet the necessary assumptions. Since some of the groups compared below do differ on the variable, it is possible that differential ability levels could be a partial explanation for some of the results.

Table 2

Summary Statistics for Aptitude Area IX Scores for All Groups

Group	N	Mean	SD
16	59	117.32	10.61
17	56	115.98	9.91
18	54	119.11	9.64
19	81	119.22	11.43
20	54	120.11	10.62
21	78	118.53	9.95
22	45	117.66	8.44
23	77	118.70	8.33
24	65	122.40	12.00
25	85	123.62	9.00

Table 3 contains the means, standard deviations, and N's for the control and experimental groups used in this series of experiments. The table entries differ slightly from Table 1 because some groups have been combined for purpose of analysis. The variation in the size of the N's for the same group from one subject-matter to another can be attributed to normal variations in class attendance and unscorable answer sheets.

Cursory examination of Table 3 indicates that: (1) for Capacitive Circuits and Inductive Circuits no experimental groups obtained a mean score that was significantly lower than that obtained by the regular instruction groups; (2) for Series Resonance the mean score for regular instruction was higher than that obtained by any of the experimental groups; (3) for Tank Circuits the mean score obtained in regular instruction was lower than those obtained by the three experimental groups.

Statistical tests ("t" tests) were then calculated for the comparisons likely to produce differences of statistical significance. It was assumed that if these comparisons were not statistically significant no others would be except by chance.

Hypothesis: Only chance differences exist between mean proficiency scores of the group receiving regular classroom instruction and the experimental group receiving the "most improved" television production variation. (Note: The assumption here is that the final improved version would yield the highest proficiency score.)

The data are presented in Table 4.

Table 4

Selected Comparisons Between Television (Production Variation) and Regular Instruction

Capacitive Circuits	Group	Number	Mean	Standard Deviation	"t"
Regular Instruction	16 & 17	114	11.39	3.33	1.78
TV-3 (Production Variation)	20 & 21	123	12.12	3.02	
Inductive Circuits					
Regular Instruction	16 & 17	116	9.39	2.95	2.48*
TV-4 (Production Variation)	21	75	10.52	3.15	

* Indicates statistical significance at the .05 level of probability.

Table 3

Summary Statistics of Proficiency Test Scores for Control and Experimental Groups

Subject Matter	Column I: Regular Instruction	Column II: Television Production Variation				Column III: Television Production Variation-Time Reduction					Column IV: Instructor Experience					Column V: Low-Cost Camera Equipment	
		TV-1	TV-2	TV-3	TV-4	TV-1	TV-2	TV-3	TV-4	TV-5	TV-2	TV-3	TV-3	TV-5	TV-5	TV-3	TV-4
Capacitive Circuits																	
Group	16 & 17	18	19	20&21								"Partly New"	"All New"			24	
Mean	11.39	11.56	12.90	12.12								23	25			12.62	
SD	3.33	3.27	2.69	3.02								12.93	12.38			3.37	
N	114	52	71	123								2.92	3.16			60	
												77	82				
Inductive Circuits																	
Group	16 & 17	18	19	20	21					25				"Partly New"			24
Mean	9.39	9.35	9.69	11.14	10.52					10.36				22	23		9.93
SD	2.95	3.31	3.18	3.24	3.15					3.26				9.80	9.81		2.93
N	116	52	74	41	75					83				2.34	2.66		56
														36	76		
Series Resonance																	
Group	17 & 18					19	20	21					All New"				
Mean	11.08					9.13	9.64	10.28					22				
SD	3.92					3.99	3.89	3.90					9.21				
N	112					76	42	74					3.96				
													42				
Tank Circuits																	
Group	17 & 18					19	20&22				"All New"						
Mean	10.38					11.43	10.56				21						
SD	2.79					3.39	3.66				10.63						
N	112					71	85				3.57						
											72						

In the instance of Inductive Circuits the hypothesis is rejected. Students exposed to the "most improved" TV variation did significantly better than students exposed to regular instruction. The difference between the two groups on Capacitive Circuits, while not reliable, favors the most improved script.

Hypothesis: Only chance differences exist between the mean proficiency scores of the group receiving the first script modification and the group(s) receiving the last.

The data are presented in Table 5.

Table 5

Selected Comparisons Between Television Script Modifications

Capacitive Circuits	Group	Number	Mean	Standard Deviation	"t"
TV-1	18	52	11.56	3.27	1.06
TV-3	20 & 21	123	12.12	3.02	
Inductive Circuits					
TV-1	18	52	9.35	3.31	2.00*
TV-4	21	75	10.52	3.15	

* Indicates statistical significance at the .05 level of probability.

For Inductive Circuits the hypothesis was rejected. Although the difference tested was not statistically significant for Capacitive Circuits, it should be noted the direction of the difference tends to favor the TV-3 production.

Hypothesis: Only chance differences occur between mean proficiency scores obtained under conditions of regular instruction and those obtained under conditions of TV presentations with maximum time reduction.

Table 6 presents these comparisons.

Table 6

Selected Comparisons Between Regular Instruction and TV Time Reduction

Inductive Circuits	Group	Number	Mean	Standard Deviation	"t"
Regular Instruction	16 & 17	116	9.39	2.95	2.15*
TV-5 (Max. Reduction)	25	83	10.36	3.26	
Series Resonance					
Regular Instruction	17 & 18	112	11.08	3.92	1.37
TV-3 (Max. Reduction)	21	74	10.28	3.90	
Tank Circuits					
Regular Instruction	17 & 18	112	10.38	2.79	.381
TV-2 (Max. Reduction)	20 & 22	85	10.56	3.66	

* Indicates statistical significance at the .05 level of probability.

The hypothesis is rejected in favor of shortened scripts only in the case of Inductive Circuits. It should be noted here that Group 25 attained a significantly higher mean score on Aptitude Area IX than did Groups 16 and 17, and this factor itself might account for the finding.

Hypothesis: Only chance differences in mean proficiency scores occur among groups taught through television by instructors varying in teaching experience.

The data to test the hypothesis are presented in Table 7.

Table 7

Selected Comparisons Between Experienced, "All New" and "Part New" Instructors

Capacitive Circuits	Group	Number	Mean	Standard Deviation	"t"
Experienced Instructor	20 & 21	123	12.12	3.02	1.88
"Part New" Instructor (TV-3)	23	77	12.93	2.92	
Experienced Instructor	20 & 21	123	12.12	3.02	.587
"All New" Instructor (TV-3)	25	82	12.38	3.16	

No statistically significant differences were found in the above comparisons, (nor in any of several other possible but less definitive comparisons). The data in Table 7 show that the students instructed by the "Part New" or "All New" instructor indeed do no worse than those taught by an experienced instructor.

Hypothesis: Only chance differences in mean proficiency scores arise when groups taught by moderate-cost camera equipment are compared with groups taught by low-cost camera equipment.

Presented in Table 8 is a test of this hypothesis.

Table 8

Selected Comparisons Between Moderate and Low-Cost Camera Equipment

Capacitive Circuits	Group	Number	Mean	Standard Deviation	"t"
TV-3 (Moderate-Cost Equipment)	20 & 21	123	12.12	3.02	.975
TV-3 (Low-Cost Equipment)	24	60	12.62	3.37	
Inductive Circuits					
TV-4 (Moderate-Cost Equipment)	21	75	10.52	3.15	1.10
TV-4 (Low-Cost Equipment)	24	56	9.93	2.93	

Only chance differences were found, suggesting cost of camera equipment did not have much measurable influence upon these proficiency scores.

DISCUSSION OF RESULTS

The results of this investigation showed that to some extent it was possible to improve scripts for television instruction. Higher mean proficiency scores were found in six out of the seven instances in which attempts were made to do this. Table 3 shows that for both Capacitive Circuits and Inductive Circuits there is an increase in learning score over regular instruction for each modification with the exception of the first modification on Inductive Circuits. Because trainee scores on the last modification for each of these subject-matters were lower than those on earlier modification, a question arises. Why aren't succeeding television presentations always better than the previous one? "Improvements" were supposedly made in the scripts, yet in some cases the intended improvements apparently were not improvements at all.

One possible explanation for this finding may lie in the script length. In endeavoring to improve television scripts the tendency was to add to the script by repetition, by increased use of visual aids and by the elaboration of concepts when a particular lesson plan objective needed strengthening. In the course of improving the scripts it was found that, with only one exception, every attempt to improve teaching effectiveness also produced a TV script that was to some degree shorter than the regular instructional hour. The time reduction ranged from five to fourteen minutes, or from 11 to 31 per cent of the regular instructional hour. In no case, however, were the time reductions as great as when the emphasis was directed toward reducing the length of the presentation.

When the emphasis was placed on reducing the time of the presentation, the data showed that revision of the scripts in this manner did not produce conclusive results. For Inductive Circuits time reduction resulted in a significantly higher mean than that obtained through the regular instruction. In the case of Series Resonance the trainee learning scores for the experimental groups were in every instance lower than those for the regular instruction group. For Tank Circuits learning scores were somewhat above that score associated with regular instruction. While the effect of reducing the length of the TV presentation does not seem very stable or reliable, certainly, significantly poorer student performance was not produced in every instance.

In endeavoring to reduce the length of the television presentation, over-repetition and excessively complex and lengthy material, both verbal and visual, were culled from the script. In replacing such material an effort was made to simplify it further and to combine it with less complex visual aids. The television scripts in this case represented complete

revisions. The time reductions achieved ranged from 16 to 27 minutes, or from 36 to 40 per cent of the original lesson plan time.

Previous investigations had pointed up the necessity for further exploring instructor qualifications for television teaching. Factors such as "stage fright", long rehearsal periods and teaching variability emphasized the need for developing methods to reduce or eliminate these effects. An important consideration was that of instructor experience. An attempt was made in this study to explore the potentialities of inexperienced instructors. Instructors with three levels of experience were used. The experienced instructors had previously taught the specific hour for each of the four subject-matters; there was one "part new" instructor, who had had experience teaching in the Field Radio Repair Course but who had had no experience teaching the hours to which he was assigned; one "all new" instructor was a man who had had no previous teaching experience whatsoever (he taught Capacitive Circuits, Series Resonance and Tank Circuits).

While the number of instructors used was insufficient to permit a reliable prediction of the effect of instructor experience on student learning, the data are certainly suggestive. There were indications that the cueing device used, the teleprompter, helped to equate the instructors used in this study. The cueing equipment contained the instructional material in typed form, as well as instructions for pointing to charts, moving from one place to another and similar guides. The end result was uniformity of content and presentation in repeated instruction and an almost complete elimination of instructor errors and omissions. The same rehearsal and training procedure was used for the experienced, "part new", and "all new" instructors. It was found that as little as two or three hours were required to prepare an instructor regardless of experience level, and it was then virtually impossible to distinguish between the "part new", the "all new" and the experienced instructors.

Vidicon television equipment available at Fort Gordon (the cost of which was about one-third that for the image-orthicon equipment) was used in the evaluation of the teaching and administrative capabilities of lower-cost equipment. The results of the experimentation on this variable indicated that the low-cost camera equipment was at least as effective as the higher priced equipment. The low-cost equipment was used for only two subject-matters--Capacitive Circuits and Inductive Circuits. In both cases the learning scores for the experimental groups were better (though not reliably higher) than those obtained by the regular instruction groups tested on the same material.

In view of the somewhat lower sensitivity of the vidicon tube, however, it would be desirable to further investigate subject matters where recognition of small parts or discrimination among small visual stimuli predominated.

LIMITATIONS

It should be re-emphasized that this research was not action-oriented. This investigation was designed to explore selected problems. Further, it should be kept in mind, that none of the findings stated above are definitive. They will, however, provide the framework for future research in the area of maximum utilization of television as an instructional medium. Listed below are limitations that should be underscored in the interpretations and uses of the findings reported above:

1) No attempt was made in this study to determine the extent to which regular classroom instruction could be improved without the use of television. Thus, it is not possible to say to what extent the improvement effected in favor of television is due to television or to the improvement of the original lesson plans.

2) The effect of the teleprompter, or "cueing" device, was not systematically varied in this experiment. The results obtained using the "part new" and "all new" instructors indicate that it is very likely this device in some way affects student learning.

3) Only selected, one-hour presentations were studied. The study did not attempt to explore the question of whether continuous exposure to teaching by television will, over time, produce an increment or a decrement in learning.

4) The design of this experiment included, for each hour of television instruction, a "built-in" question-and-answer session that was derived from questions raised in previous regular instruction sessions. No evidence is presented of the extent to which this "impersonal" approach will affect motivation, and, in turn, learning.

5) Administrative reasons prevented randomly assigning the trainees used in this study to experimental and control groups. As a result, ability differences (Aptitude Area IX scores) were not subject to experimental control. This somewhat increases the risks involved in generalizing from those findings to other instructional situations.

CONCLUSIONS

In evaluating the findings reported here it should be emphasized that they were obtained with four hours of instruction selected from a specific section of a course of six months duration.

1. The results indicate that it is possible to improve television effectiveness for a particular hour of instruction. While successive modifications of the regular instruction lesson plan adapted for television did not always show improvements in teaching effectiveness, the scores obtained with the TV modification were generally better than scores obtained on regular instruction. The findings show that some of the earlier modifications were better than the subsequent ones. This suggests that modifications introduced in later productions, based on analysis of previous TV presentations and on rational considerations, did not necessarily lead to TV productions that effect an increase in learning. It was possible to improve the teaching effectiveness of TV instruction, but it was not possible to predict whether a later TV version would be superior to an earlier one. It appears that what is needed is a more comprehensive study of the specific factors that are related to teaching effectiveness.

2. The effect upon student performance of successive reductions of the television script length was not conclusively demonstrated. In three instances (all involving Series Resonance instruction) out of six where the emphasis was placed on time reduction, the scores achieved by time reduction groups were lower than those achieved by the regular instruction group. With Inductive Circuits, the reduced script score is significantly better than the score obtained on regular instruction. With Tank Circuits the reduced scripts performance scores are as high or higher than regular instruction scores. An important question still to be answered is the effect of time reduction on retention of previously taught material and the learning of subsequent material.

3. One of the most provocative observations from this work is the suggestion that inexperienced instructors, with a minimum of training, could effectively present technical material in lecture fashion via television. Such a finding, if it receives further confirmation, has important implications for Army training, in view of the ever-present problem of instructor shortages and rapid turnover of qualified personnel. Additional studies should be conducted on this matter, involving larger samples of instructors.

4. The findings on the use of low-cost camera equipment suggest that it is no less effective than moderate-cost equipment. It is strongly suggested, in view of budget considerations, that further research be conducted regarding the use of low-cost equipment. Subsequent studies should focus upon subject-matters where the visual component is far more critical for learning and teaching effectiveness than was the case in the present study.

5. The results of the present study, although limited in scope, have served to increase the existing knowledge of the potential applicability of television to Army training problems. The data presented here show that television is as effective as regular classroom lecture methods for the subject-matters studied.

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This report describes a series of studies designed to investigate (1) procedures for improving television instruction, (2) use of television techniques for reducing instructional time, (3) problems involved in training instructors to teach by television, and (4) whether use of lower-cost television equipment affected student learning.

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