A STUDY OF THE EFFECT OF SUPPLEMENTARY INSTRUCTIONAL TELEVISION ON SCIENCE ACHIEVEMENT BY FIFTH AND SIXTH GRADE CHILDREN FROM A LOW SOCIO-ECONOMIC BACKGROUND

SUE ANN MAYS

To the Graduate Council:

I am submitting herewith a Thesis written by Sue Ann Mays entitled "A Study of the Effect of Supplementary Instructional Television on Science Achievement by Fifth and Sixth Grade Children from a Low Socio-Economic Background." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Arts in Education, with a major in Curriculum and Instruction.

Lois Brosman
Major Professor

We have read this thesis and recommend its acceptance:

Wayne E. Stamp
Minor Professor

Elsie P. Oakley
Third Committee Member

Accepted for the Council:

Wayne E. Stamp
Dean of the Graduate School

A STUDY OF THE EFFECT OF SUPPLEMENTARY INSTRUCTIONAL TELEVISION ON SCIENCE ACHIEVEMENT BY FIFTH AND SIXTH GRADE CHILDREN FROM A LOW SOCIO-ECONOMIC BACKGROUND

An Abstract

Presented to

the Graduate Council of

Austin Peay State University

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

in Education

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by

Sue Ann Mays

August 1970

ABSTRACT

The purpose of this investigation was to determine if there was a statistically significant correlation between the use of instructional television as a learning supplement in science instruction and achievement scores of socio-economically deprived children. The research hypothesis states that there is no significant difference in measured achievement between fifth and sixth grade children who viewed instructional television and peers who did not view instructional television as a part of their science instruction. The study was limited to Caucasian and Negro children living in urban Hopkinsville, Kentucky, and attending Virginia Street School.

Both control and experimental groups were treated to identical materials and methods, except for the viewing of instructional television. From September 9, 1969, through May 14, 1970, the experimentals viewed science lessons broadcasted by Kentucky Authority for Educational Television in Lexington.

The instruments for collecting the data were the Kuhlmann-Finch Intelligence Test, Stanford Achievement Test, scores from chapter tests, and tests based upon achievement test booklets published by D. C. Heath and Company.

Two variations of a double-classification of analysis of variance for equal and unequal subclasses were

used to determine significant differences in achievement between control and experimental groups. Analysis of the data led to the acceptance of the hypothesis at the 5 percent level of significance, indicating that these samples from a low socio-economic population achieved successfully on the basis of their intelligence rather than on the basis of the instructional method employed.

It is recommended that some advantageous usage of instructional television can be achieved provided that the series presents valuable experiences which cannot be supplied by the classroom teacher, provided that the level of the instructional technique, terminology, and concepts is not more advanced than the comprehension level of the students, and provided that an adequate viewing schedule can be arranged.

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ACKNOWLEDGEMENTS

The writer wishes to express sincere appreciation to Dr. Wayne E. Stamper, Graduate Dean, Austin Peay State University, who aided in arranging the investigation and provided invaluable help and counsel during the course of the study; to Mrs. Lois Bousman, Department of Biology, Austin Peay State University, who provided unlimited guidance during the researching and writing of the thesis; to Mrs. Elsie Oakley, Department of Education, Austin Peay State University, who offered constructive criticisms of the manuscript; and to Dr. Garland Blair, Department of Psychology, Austin Peay State University, who provided invaluable assistance in the analyzation of the data.

Appreciation is extended to Mr. John Randolph, principal, and to fellow teaching staff members of Virginia Street Elementary School, Hopkinsville, Kentucky, for their cooperation and encouragement given during the course of the investigation. Gratefulness is also extended to D. C. Heath and Company for permission to use their achievement tests as a source for evaluative tests administered during this study.

TABLE OF CONTENTS

Chapter Page

LIST OF TABLES

Chapter 1

INTRODUCTION

The purpose of this investigation was to determine if there was a statistically significant correlation between the use of instructional television as a learning supplement in science instruction and achievement test scores of socio-economically deprived children. The basis for such a study is the need to describe and empirically examine the effect of instructional television (ITV) on pupil achievement. Knowledge related to the effects of educational technology could serve as a basis for making instructional procedure changes. Such changes are imperative as a response to critical problems in today's schools.

Schools are facing constantly mounting problems: ever-increasing enrollments and operational costs, qualified teacher shortage, tremendous family migrations among the working classes, emigrations from the inner city to the suburb, and higher qualifications for school graduates required by society (30, pp. 169-170, 172). How can schools best respond to the pressures exerted by these problems?

During the past decade, technology has amazingly revolutionalized American life. Yet the application of technology to education has only begun. The potential for a broader application is tremendous (10, p. 367). In the face

of increasing societal requirements, educators need every assistance which relieves routine and frees them to work more closely with their pupils. Television may be a technological instrument by which this much needed aid can be offered to educators (30, p. 172). From the time of its earliest use for educational instruction, television has been the target of extensive research studies. The Fund for the Advancement of Education of the Ford Foundation and Title VII of the National Defense Education Act have supported numerous projects (10, p. 369). Supported by such resources, Virginia Street School has implemented the use of ITV in various subject areas and grade levels as a part of regular classwork procedures.

For this investigation an experimental group and control group were selected from both the fifth and sixth grades at Virginia Street School. The experimental groups viewed ITV once a week as an instructional supplement. The control groups did not view instructional television.

The remainder of Chapter One will deal with a statement, analysis, and delimitation of the research problem, and with the definitions and basic assumptions underlying the theoretical framework of the study.

Chapter Two is a report and discussion of the literature surveyed related to the study. This survey includes characteristics of culturally disadvantaged children and their home life and of types of science programs which might best meet their needs. The currently

emphasized instructional approaches in the field of elementary science are described in terms of content, process, attitude, and inquiry. In addition, two patterns for arranging instruction, departmentalization and the self-contained classroom, are surveyed. Research reports about the status of ITV as an instructional tool terminate the chapter.

Chapter Three contains a description of the procedures used in this investigation and includes the following topics: design and treatment, study area, materials, and data sources. An analysis of the data, interpretation, and recommendations derived from the investigation constitute Chapter Four. Chapter Five, a summary of the thesis, culminates the paper.

PROBLEM

Much of the educational television (ETV) media research has been concerned with a measure of the acceptance or effectiveness of television as an instructional tool (10, p. 369). Television has been the subject of research studies at all grade levels and in almost every subject field (32, p. 19). This investigation was initiated because of a need for further study concerning the interaction of television and the learning achievement of children who come from a socio-economically deprived background. The problem was designed to study the effect of ITV as an instructional tool in upper-elementary science instruction.

Statement of the Problem

This research is designed to obtain statistical evidence of any correlation between ITV and student scores on intelligence, achievement, and paper-and-pencil science tests.

The research hypothesis states that there is no significant difference in measured achievement between fifth and sixth grade children who viewed instructional television as a part of their science instruction. The significance level of 0.05 was used as the criterion for evaluating the acceptance of the hypothesis.

Analysis of the Problem

The statistical method utilized to analyze the data was a double-classification analysis of variance. Two variations of the analysis formula were used in order to accommodate equal numbers in the subclasses of the fifth grade data and unequal numbers in the subclasses of the sixth grade data. The significance of the differences in group means was determined by figuring the F-ratio and comparing that ratio with the F-values at 0.05 level of significance. Chi square was used to determine whether or not the frequencies observed in the sample departed significantly from expected frequencies.

Delimitations of the Problem

The study was limited to Caucasian and Negro children who came from urban middle-and lower-class families

in Hopkinsville, Kentucky. These children attend Virginia Street School, a school classified by the Office of Health, Education, and Welfare as one serving a "disadvantaged" area. The period of study coincided with the initiation and termination of the science lessons broadcasted by the Kentucky Authority for Educational Television (KETV) in Lexington, Kentucky, that is, from September 9, 1969, through May 14, 1970. During this interval the following instruments were used as the means of gathering the data: Kuhlmann-Finch Intelligence Test, Stanford Achievement Test, objective science test items selected from test booklets published by D. C. Heath and Company, chapter and vocabulary test scores.

THEORETICAL FRAMEWORK

The purpose of this study is to measure the difference in test scores between children who viewed ITV and those children who did not view ITV as a part of their science instruction. The intent was to determine if there was a statistical correlation between ITV and student intelligence, achievement, and paper-and-pencil test performances.

Principle

The learning principle upon which this investigation was based is that learning is associated with the presentation of visual and auditory stimuli or with

responses evoked by these stimuli (4, p. 238). The assumptions deduced from this principle are as follows:

1. that audio-visual stimuli are presented by television

2. that television can be used to present stimuli which are related to particular subject matter areas

3. that television can teach science effectively

4. that fifth and sixth grade children can learn effectively from television

5. that culturally and economically deprived children can learn effectively from television.

The objective of this investigation was to test the fifth assumption specifically. Thus, this assumption has been formulated into the working hypothesis for this study.

Terms such as "disadvantaged," "intelligence," "instruction," and "educational television" often convey ambiguous meanings. In order to better denote the meaning of these terms, they are discussed and defined descriptively and operationally.

Definitions

During recent years the term "disadvantaged" has gained popular usage as a label for those children of the poor who are victims of social, intellectual, emotional, and physical restrictions (12, p. 13). Yet there is evidence within the literature that there is little agreement upon the use of terminology or upon the definition of these terms

which relate to cultural, economic, and educational deprivation (20, p. 10). Rees refers to those who need compensatory education as being "deprived." For her usage, deprivation means not having those broad essentials necessary to provide a higher level of living (20, p. 11).

Hellmuth described a disadvantaged child as one who is deprived of the same opportunity for healthy growth and development which is available to the vast majority of the society. He limits the term to those children from poor families who provide a disproportionate incidence of academic failures and whose full-grown offspring display a lower socio-economic standard of living (16, p. 21).

The references within this paper concerning disadvantaged children designate those who display an educational, cultural, economic, or social handicap. It is inferred that educational disadvantages may be related to the cultural or socio-economic effects on differences in learning patterns. Terms which may be used synonymously with "disadvantaged" are "culturally deprived" or "socio-economically deprived."

The Winston Senior Dictionary has defined intelligence as the ability to learn; to profit by experience; to acquire knowledge, comprehension, understanding; to reason and think abstractly (27, p. 511).

Good described abstract intelligence as the ability to make effective use of concepts and symbols in thinking. He defined intelligence in measurement terms as the ability

indicated by performance on a battery of tests selected because of their practical value in predicting academic and vocational success (14, p. 293).

For Thorndike, intelligence was a matter of how many words the learner knew. He stated that learning was the result of the formation of a vast network of connections in the brain as the result of the "right experiences" being experienced by the learner. Increased connections give one intelligence and education (4, p. 61).

Piaget separated intelligence into two phases: intellectual structure and intellectual function. Intellectual function referred to general characteristics of intelligent activity which define the essence of intelligence itself, whereas intellectual structure referred to the organized aspects of intelligence which can change with age (9, p. 86).

Davidson and Greenberg suggested that intelligence can be conceptualized as the level and style of cognitive functioning which arise from experience with particular types of stimulation (8, p. 6). Within the scope of this study, the term "intelligence" will be used to mean the ability to acquire knowledge and profit from experience.

"Instruction" refers to any specific means of controlling a sequence of events in order to produce a modification in behavior (13, p. 584). This definition of instruction which has been stated will serve as the standard for the paper.

The term "educational television," in popular usage, connotes any program bearing an educational aspect of presentation. Technically, this noncommercial medium has two aspects. "Educational television" more accurately refers to those programs of an educational or cultural nature directed toward the general public. The other aspect of television refers to those programs which deal primarily with formal education and which present a qualified instructor in a teaching situation for classroom viewing. This type of television is best described as "instructional television" (6, p. 15). However, within this paper whenever references are cited, either ETV or ITV may be used in accordance with the terminology used by the author of the citation. In discussing the project, however, this investigator will use the term "instructional television" because of its more exact meaning.

Chapter 2

LITERATURE SURVEY

This survey of the literature is limited to disadvantaged children, approaches to teaching elementary science, and research related to instructional television.

THE DISADVANTAGED

According to Frost, the problem of poverty exists in every geographical area of this country: the slums, certain rural areas, migrant labor camps, and Indian reservations (12, p. 1). He uses the term "disadvantaged" to describe those children who come from very poor families who invariably suffer social, intellectual, emotional, and physical restrictions (12, p. 13).

What are the characteristics of the culturally deprived or disadvantaged child? Dr. Newton Metfessel characterized four factors which are assumed to operate in the lives of children from a low socio-economic background. These factors are language factors, learning patterns, readiness for instruction, and school behavior (12, p. 46).

Language Factors

Disadvantaged children understand more verbal language than they use, although this does not imply a wide hearing or understanding vocabulary. They use many words

with fair precision, but not necessarily words related to the school culture. Many do not perceive that objects have names or that the same objects may have different names. Such disadvantaged children use fewer mature sentence structures (12, p. 47).

Learning Patterns

Disadvantaged children tend to learn more easily by inductive approaches and tend to distrust their own judgment, looking for the support of an authoritarian figure in the classroom. Frequently symbolically deprived, the disadvantaged need to see concrete application of their learning to their immediate sensory satisfaction. Because of poor attention span, they follow the directions of a teacher with difficulty (12, p. 48).

Readiness for Instruction

Having a background which has not prepared them adequately for success in the traditional school, these pupils are characterized by gaps in knowledge and learning and have difficulty in participating in communication procedures totally alien to them. Their problems are multiplied by frequent movement from one school to another (12, p. 49). The student population in this study manifested this tendency.

School Behavior

Disadvantaged children are usually unaware of the

"ground rules" for school success; that is, they are not cognizant of the disciplines or habits needed to gain academic successes (12, p. 49).

Samuel Malkin, who worked with disadvantaged children in the Higher Horizons Program conducted by New York City Schools, noted a general lack of achievement in reading, writing, and mathematics; a low self-image; lack of interest and of experiences with an environment any larger than their neighborhood (12, p. 328).

Based upon his studies in the field, Frank Riessman cited certain characteristics peculiar to culturally deprived children. These characteristics may at times be in contradiction to each other, a contradiction that results partly from the deprived child's being affected by his own group and by the larger society (21, p. 26). These deprived children are relatively slow at cognitive tasks and appear to learn most readily through a physical, concrete approach. Except for a major section of the Negro subculture, these children are generally from a male-centered culture. Many value masculinity and view intellectual activities as unmasculine. Often appearing anti-intellectual, they may appreciate knowledge for its vocational practicality but not merely for its own sake. Although this group may desire a better standard of living, they generally do not wish to adopt a middle-class way of life. Inflexibility and a closed mind to reasoning may further characterize deprived children. Frustrations and the blaming of others for their

misfortunes may result from a feeling of alienation from the larger social group. Within the classroom many of their problems may result from a deficiency in interpretive skills, auditory attention, and in communication skills in general.

In assessing some of the strengths of the culturally deprived child, Riessman described them as being relatively free of stresses which accompany competitiveness and as being free of self blame. They often display a genuine cooperativeness and helpfulness which is probably derived from being a member of a large family (12, p. 46).

For many years measures have been made of the differences in school achievement and general intelligence between social classes and ethnic groups. Repeatedly, the middle-class groups achieved higher scores than did the lower-class groups, with white populations scoring better than Negro populations. Recent studies have indicated that these class and race differences still remain. Results of Coleman's study, involving 645,000 children, indicate that school achievement of white children was higher than that of Negro children. He found that in the Northeast the differences in reading and mathematics were almost two years by grade six, with the gap increasing to three years by the twelfth grade. This cumulative deficit has also been found by Deutsch (8, p. 4). Two large-scale studies made in the South by Osborne and Cooper indicated that differences between Negro and white children increased as they advanced from fourth through twelfth grade. From the work done at

the Institute for Developmental Studies, Deutsch concluded that within both Negro and white groups, social-class level and achievement were substantially related and that race was a less significant variable (8, p. 5).

B. C. Rosen found in his studies that the lower-class population generally showed relatively low achievement motivation. Inversely, the Negro segment of the lower-class displayed surprisingly higher achievement values than their class counterparts. He concluded that perhaps the Negro lower-class child truly values learning but often does not see it as possible for himself (8, p. 7).

Because of educational problems that disadvantaged children face, special school programs should be designed for these children. Malkin described an elementary program for culturally deprived children which is based upon the child's environment. The program was developed from elements familiar to the child, building and enlarging upon them. Thus, this program is based upon real problems. By solving real problems the child answers his own questions. This approach to science instruction does not require reading or other academic skills which these children lack. Skills such as listening, speaking, reporting, and observing are promoted. A variety of audio-visual aids and multi-level textbooks is implemented. These children have greater achievement when tasks are motor-oriented; therefore extensive opportunities for the children to handle materials and equipment are available. As the children express some

of their feelings of success, they are then motivated to attempt reading and other achievements (12, pp. 329-330).

ELEMENTARY SCIENCE PROGRAM

For many years, the approach and organizational design required for implementation of instruction have been discussed. Currently, there are three major approaches and supportive designs considered by elementary science curriculum developers: content, process, and attitude. This review includes content, process, attitude, and inquiry, a variation of the process approach, as potential instructional procedures.

The following definitions have been selected to contrast the proportionately different emphasis manifested in the content, process, and attitude approaches. Content implies an emphasis made on the scientific concepts, theories, and principles to be learned. The process approach stresses the skills needed to achieve science knowledge: prediction, experimentation, and interpretation. The attitude approach aims at the development of the ability to act in scientific matters (25, p. 1). The methods implemented in the process approach are analogous with those of the inquiry approach. Heathers reported a major effort to devise a science curriculum sequence based upon levels of sophistication in the "scientific process of inquiry." This method of instruction is designed to teach children to perform mental operations such as classifying, arranging,

and describing (1, p. 268). Regardless of the method selected, the teacher's responsibility is to direct the discovery of relationships (1, p. 265). Such acts of discovery precede acts of inquiry.

The organizational design is expressed in the arrangement for instruction. Departmentalization and the self-contained classroom are examples of traditional designs. Both approach and design are intended to improve student achievement of the educational goals. Atkin reported the results of a comparative study conducted under the direction of the American Association for the Advancement of Science. Results of science instruction by special teachers were compared with results of instruction by teachers in self-contained classrooms. Fifth and sixth grade children from four school systems were matched on the basis of intelligence and achievement. Results of the study indicated that children, regardless of their intelligence or ability, learned science more effectively when taught by the special teacher (1, pp. 269-270).

The television series viewed by the sixth grade in this study instructed using the process approach. This approach meets a set of objectives by analyzing the resources given. The scientist's tools of investigation such as observing, interpreting, and hypothesis generation are developed. Learning these discovery and inquiry techniques is a primary objective. Content is not the means which provides the learning. Scientific investigations

constituted the setting for the students to discover new information. The television teacher presented problems or aided the children in identifying the problem. After leading the children through a partial solution, the instructor encouraged them to conclude the investigation after the program. Otherwise, the instructor simply posed a question and left the children to find the entire solution. It is assumed that children who have been taught by this approach have not amassed a conglomerate of facts or theories but have developed and improved their skills in using the tools of science (17, pp. viii-ix).

The preceding sections have examined research literature which related to disadvantaged children because the study involved this type of population sample. A brief survey discussed the content, process, attitude, and inquiry approaches to teaching science because the methods used in the study were content and process. The remainder of this chapter will describe literature related to ITV, examining its history, usage, characteristics, and effectiveness.

INSTRUCTIONAL TELEVISION

A. N. Whitehead once stated that the best education gains the most information from the simplest apparatus. Simplicity remains the key to effective teaching on all instructional levels. Advances in educational theory and in instructional methods have not altered this axiom (15, p. 1). To many educators, television appears to be a simple

"means of unraveling the knotty quantitative academic and administrative difficulties" that education faces (12, p. 2).

Applying technology to education is not a new development. The printed book, the first teaching machine, freed the teacher from supplying all the content. Following closely in usage came pictures, charts, magazines, newspapers, pamphlets, films, and filmstrips. Lastly came record players, teaching machines, language laboratories, tape recorders, television, (23, pp. 173-74) and computers.

Before examining the nature and usefulness of television as an instructional tool, some understanding of the historical development of instructional television is needed. When the Bell Laboratory demonstrated in 1927 that television was workable, educators quickly recognized its instructional potentials. Evidence of this recognition is shown by the fact that some of the earliest television experiments were conducted by educational institutions. In 1933 the University of Iowa's Department of Electrical Engineering transmitted its first formal broadcast from a new ETV station, W9XK, in Iowa City. Purdue and Kansas State Universities were experimenting with similar television services (18, p. 133). However, these modest beginnings were halted by the effects of World War II.

In 1944 far-sighted educators made vain attempts to secure ETV channels from the Federal Communications Commission (F.C.C.) (18, p. 135). Therefore, it was left to the commercial stations to be the first stations to actually

offer educational instruction (15, p. 51). In 1949 with the aid of educators, NBC developed a series of children's programs, "Stop-Look-and Learn," which was aired after regular school hours (18, p. 138).

In 1947 one of the first in-school uses of ITV was inaugurated: a weekly program presented by the Philadelphia Public Schools in cooperation with stations WPTZ, WFIL, and WCAU. By the early 1950's this service had increased to thirteen programs a week. In addition to the Philadelphia Project, Wilmington, Delaware, and Nutley, New Jersey, have become leaders in the utilization of ITV (18, p. 137). The University of Texas, Creighton University, and University of Michigan increased their broadcast undertakings in 1948 (18, p. 138). The military services began to use television to implement new methods of instruction and to train their instructors. Today ITV is widely used in military installations and academies (18, p. 142).

The official development of ETV began with the formation of the Joint Council on ETV, October 16, 1950. Educators were strongly supported in their new bid for reserving television channels by F.C.C. Commissioner Freida Hennock. In April 1952, there were 242 channels reserved for educational use (18, pp. 139-140). By 1955 ten stations across the country had begun transmission, with ninety broadcasting by 1964 (15, p. 9). Thus, by the end of the 1950's ITV trends became established. Yet the question remained of how best to use television in education.

Another major development in the history of ITV came in 1959 when the Ford Foundation supported Purdue in devising a plan to broadcast lessons from an airborne transmitter. The Midwest Program for Airborne TV Instruction (MPATI) operated experimentally in 1961, covering a six-state area. In 1965 the F.C.C. denied the MPATI petition for its continuance claiming possible detriment for the potential growth of local ground-based ETV stations (18, p. 144).

Current indications of an extensive use of ITV is seen in Alabama where open-circuit television classes are broadcast on a statewide basis (15, p. 54). Another major project is the elaborate closed-circuit facilities built in 1956 in Washington County, Maryland, under the "benevolent patronage" of the Ford Foundation (15, p. 59).

Having surveyed major developments in the history of ITV, the characteristics, potentialities, and limitations of television will be discussed. Television is characterized by its semblance of reality, combining sight, sound, action, and immediacy. Television can convey personality; bring efficient, quality instruction; focus on important aspects of a lesson; make superior use of audio-visual material; do things classroom teachers cannot; and stimulate long-range interests and action (30, pp. 174-75).

Dale has enumerated the values of ITV. He stressed these qualities: concreteness of the real, challenge of the unexpected, uniformity of communication, succinctness of

explanations, reinforcement of existing understandings, and versatility of the medium (7, pp. 201-2).

Other potentialities of the television medium which can be used to advantage are direct address, visual magnification, sound amplification, and selectivity (29, pp. 64-66). Trow concluded that television is most effective in the perceptual phases of learning as it provides sensory experiences and cues and as it orients, informs, and inspires the learner to further study (28, p. 85). It can convey information earlier than most media because it does not rely primarily upon the reading skills (23, p. 66).

McKown has enumerated specific ways which ETV can improve instruction. Television can help to make learning more permanent as it builds the experience background of the students. Television can teach more in less time and can improve listening comprehension (19, pp. 1-2).

However, the character of ITV is Janus-faced, a fact the authorities readily recognize. There are feats which television cannot accomplish: television has limited detail which restricts the type and size of materials and settings which can be shown. The camera has difficulty in obtaining the use of restricted or copyrighted materials. From the teaching-learning standpoint, a great limitation is the handicap created by the one-way communication between television teacher and the pupils. Furthermore, the lesson has the quality of continuous flow, a pace that cannot be adjusted to meet the needs of the viewers. One youngster

remarked, "You only have one chance. You have to grab it as it goes by." (29, pp. 67-73).

Trow felt the chief disadvantage to ITV is that it is a viewing and listening device only. No other action is possible while the lesson is being viewed: no viewer participation, no pauses to reflect, no opportunity to take notes. The small screen necessitates several sets in the room in order for all to see clearly a picture which may not have a clear definition (28, p. 87). An aspect which may cause difficulty is the fact that television depends upon the cooperation and understanding of the classroom teacher in order for the presentation to be of value to the students (32, p. 18). Tyler described the difficult adjustments which the school and teacher who use ITV must make in order for the educative process to work properly (31, p. 51).

Schramm concluded from his 1958-1959 studies in San Francisco, Clifton, Denver; Radiotown, Canada; and Teletown, Canada, that preschool viewing of television by children affected their attitudes toward ETV. Results of his analysis indicated that children had difficulty thinking of television in an educational role because of an ingrained idea that television was for fantasy (23, p. 26). Therefore, children's objection to ETV is that they do not enjoy purposeful and intentional learning from television. They cannot view the program for entertainment as they do regular television (23, pp. 58-59). After studying British children who viewed television, Himmelweit supported the fantasy

hypothesis. Bailyn analyzed the media habits of six hundred fifth and sixth grade children in New England, concluding that an important goal children sought on television was "escape" (23, p. 69).

Understanding the potentials, characteristics, and limitations is only a part of the total picture. Knowing the conclusions reached by researchers relating to the effectiveness of ITV as an instructional tool is essential.

A number of groups have funded studies designed to determine how television can be effectively used as an instructional tool. The Fund for the Advancement of Education, established by the Ford Foundation in 1961, was the major contributor which funded station constructions and experiments related to the use of ETV from the elementary through college levels (18, p. 141). Several federal programs have been helpful in ETV research and utilization. The National Defense Education Act of 1958 funded studies related to ITV under Titles III, VI, and VII. The Higher Education Act of 1965, Title VI, and the Elementary and Secondary Education Act, Title III, are two other federally supported projects. The Educational TV Facilities Act of 1962 provides matching grants for the construction or expansion of ETV broadcasting stations (18, p. 148).

From his research projects conducted in 1958-1959 in five North American cities, Schramm concluded that the effectiveness of television as an instructional aid has been

well demonstrated. If motivation can be maintained, the average student will learn as much from television as from the classroom teacher. However, in his San Francisco studies, Schramm found that the percentage of children who thought television helped them to learn more easily decreased as they grew older. The elementary school percent was 70 while the high school figure dropped to below 40 percent (23, pp. 90-91).

William Brish reported on the use of ITV in Hagerstown, Maryland. Elementary school students spent 10 percent of their classroom time viewing television with the results that pupil achievement improved significantly. The curriculum was enriched and upgraded more easily and economically (10, p. 367). This experiment was judged to be successful by the teachers involved, outside experts, and researchers (15, p. 59).

In Alabama, statewide utilization of ETV has raised the standard of instruction in elementary and secondary schools, temporarily arresting or solving many problems peculiar to the Alabama educational system (15, pp. 54-55). Virginia is another state which has developed a widespread network for ITV. In the introduction to the utilization guide prepared by the Virginia State Department of Education, it is stated that the Department believes ITV can make a definite contribution toward upgrading the quality of education in all public schools in Virginia. However, the key to success is found in the attitude of the teacher.

Carpenter stresses the fact that experiments have shown that television is useful in teaching simple skills and concepts, in encouraging creativity, and in stimulating original thinking. He also indicates that television can reinforce previous learning, especially when it is used with other kinds of instruction such as printed media. However, many practical problems may adversely affect the utilization of television in any classroom. For example, scheduling problems may hinder the effectiveness of television (15, p. 87).

The bulk of studies to date, based upon responses from 1203 elementary school pupils and 2845 high school pupils who were exposed to a wide variety of types of programs, indicate that three fourths of the younger children believed they learned more from their television classes. However, only one third of the high school students thought the televised classes were more valuable than conventional instruction (15, p. 90), a corroboration of Schramm's report. In 1956 Kumata summarized seventy-four television research studies and concluded that students who viewed television usually achieved as well as other students, occasionally achieving better (10, p. 370).

In compiling the results of nearly four hundred quantitative studies which compared ITV and classroom teaching, Schramm found that televised instruction was used with greater success in grades three through nine than in the higher grades, with more success in science and

mathematics than in other subjects (22, p. 165). Other researchers have described ways that ITV can aid the teaching of science. Television can utilize unusual specimens, demonstrate scientific phenomena not available to the regular classroom, increase interest and curiosity in all areas of science, help students think in a scientific manner, and develop science skills (32, p. 62).

However, not all research reports are so inclusively positive. Former president of the National Association of Educational Broadcasters, Harvey Skornia, laments that many of the so-called research studies are conducted by persons with no research training or standards. Because these projects do not meet valid research criteria, too few significant studies have appeared (18, p. 212).

Twyford commented that television research is often an "afterthought to be endured, or is just an opportunity to get additional funds" (18, p. 215). Another critic, Malcolm MacLean, published a scathing review of numerous early Title VII ETV researches in 1962 (18, p. 216).

For his doctorial thesis at Pennsylvania State in 1963, David Stickell analyzed thirty-one studies that made 250 comparisons between ETV and conventional instruction. He judged each comparison by the criteria of comparability of control and experimental groups, assignment of procedures, comparability of instructions, tenability of statistical assumptions, and adequate control of variables. Only ten of these 250 cases were fully interpretable. Twenty-three were

partially interpretable, and 217 that did not meet two or more of the criteria were uninterpretable. No significant differences were found in all ten valid cases and in twenty of the twenty-three partially valid cases (18, p. 218).

Gordon reported that in most of the cases which he reviewed that students taught by television did almost as well as students taught under regular conditions. This "no appreciable differences" appeared to hold true under an enormously wide range of conditions: whether the subject matter was abstract or concrete, or the teaching was of concepts or skills; whether grade or high school children were sampled, and usually whether the television was enrichment, supplemental, or total teaching (15, p. 83).

The following data were taken from Schramm's summary of 393 cases which had adequate design, controls, and statistical treatment. The results, which compared television and classroom teaching from the third grade through college, were that there was no significant difference. The total results were eighty-three cases for television significantly superior at the 0.05 level or below, 255 cases of no significant differences, and fifty-five cases of television significantly inferior to classroom teaching. For grades three through six, the result was fifty cases of superior instruction by television, eighty-six cases of no difference, and sixteen cases of inferior instruction by television. These same case findings were broken down into subject areas. For grades three through six in science, the

results showed eight cases when instruction by television was superior; fourteen cases of no significant difference; and one case when television was inferior to classroom teaching (22, p. 157). The conclusions are that when usual achievement tests are used to measure the student's progress, in 65 percent of a large number of comparisons between televised and classroom teaching, there is no significant difference. In 21 percent of the comparisons, students learned significantly more from television, while 14 percent learned significantly less (22, p. 158).

In 1960 Kumata revised his earlier inventory of research on ITV in the light of later research findings. After examining 121 studies, he found that the majority were concerned with the problem of information gain. Students exposed to television do learn some factual items from viewing the television. However, most of the studies reported no significant difference when information gain was compared between students who were taught by ITV and those who were taught under face-to-face conditions. Holmes reported that of 281 comparisons he examined, 246 produced no significant differences. The same result was reported for a variety of conditions: large and small television classes, television classes with discussion follow-up, television classes with two-way communication facilities installed in the classroom, and with television classes offering instruction periods of varying lengths (24, pp. 178-79.

Differences between test groups seem to be better explained by conditions other than the fact of television transmission. For example, many differences favoring students who viewed television have appeared in projects at the elementary and secondary school levels (Ford Foundation, Hagerstown, Philadelphia Public Schools). Television did not carry the entire load in these projects but only augmented regular instructional procedures. Where television transmission may have a definite effect is in the possible increased attention on the part of the pupil's awareness of the novelty of the situation. Macomber and Siegel found that television students did less well in the second semester of a year-long sequence whereas no differences were found between the experimental and control groups in the first semester.

Kumata found no significant differences in information gain between those students who had a prior course by television and those who had not. He did find that students who had previous television classes were significantly more favorable in their attitudes toward instruction by television (24, p. 179).

Kanner first introduced the factor of intelligence level in relation to learning from television when he studied military basic trainees. In this case he found that low-ability students learned more from television than from face-to-face instruction, while the high-ability students did not. Later studies produced mixed results (Pollock,

Carpenter and Greenhill, Cincinnati Public Schools, Chausow and Erickson, Klapper-Lepore-Wilson, and Seibert). One explanation for the differing results undoubtedly lies in the comparability of population samples (24, p. 180).

Concerning the retention of subject matter, Kumata found the same no significant difference pattern throughout the 121 cases. The amount of time elapsing between the presentation of the course and the retention testing ranged between thirty and forty-five days (24, p. 181).

In consideration of the question of feedback, recent studies indicated that the students prefer to have two-way communication facilities when they are watching television, but this variable does not affect achievement scores. In all studies in which talk-back facilities were used, no significant differences were reported (Anderson and Vander-Meer, Carpenter and Greenhill, Davies-Gross-Short, Los Angeles City Schools, Seibert, and Throop-Assini-and Boguslavsky) (24, p. 181).

Attitude and acceptance studies have shown that student attitudes were largely negative. However, most elementary students accepted television more readily than did high school and university students. In comparison with those students who have not received televised instruction, the viewers gave more favorable responses to using television as a medium of instruction (Dreher and Beatty, Klapper, and Throop-Assini-Boguslavsky). When the viewing students were asked if they would enroll in another

course taught by the television, the majority chose the conventional class (24, p. 182).

Kumata compared his 1960 summary to his 1956 survey of research. He noted that many more findings of no significant differences were reported while at the same time there was an increase in the number of studies which had reported significant differences in favor of television. Most of these later studies were done at the elementary or high school level. The pattern of his survey findings suggested a tentative categorization: (1) the mode of presentation, whether television or face-to-face, apparently had little effect on how much knowledge is retained; (2) motivation is a prime factor in determining how much is retained; (3) adequate and skillful preparation of subject matter and integration into a teaching process are important factors in learning; (4) television seems to affect the different intellectual levels of the students in varying ways, a fact which is not quite understood as yet; (5) interaction is a prime variable in learning; and (6) attitudes toward television are not related to the amount of the student's learning but are conversely related to the student's likelihood of taking another class taught by television (24, pp. 184-85).

Other researchers have gone further in their conclusions and presented a totally negative picture. Bugelski stated that the small-screen, colorless television productions are limp imitations of motion pictures. Thus,

television has no more instructional value than do films (4, p. 260). Himmelweit, Oppenheim, and Vince found that students who viewed classroom television usually achieved a little less well than the nonviewers. They discovered that television appeared to hinder rather than help the brighter child. This research was conducted during 1955-1956, involving 946 thirteen and fourteen year old British students and 908 ten and eleven year old British students, half of each group viewing television (23, p. 152).

The Carnegie Commission in 1967 recognized the potentialities of ITV and the contributions it had already made throughout the country. However, the Commission, and those whom they interviewed, felt that the role of television in education had been mainly a small one and that the real potential of television has yet to be utilized. The Commission found its views reinforced by Learning by TV, published by the Fund for the Advancement of Education, in which conclusions, no more favorable than the Commission's, were reached. Not having been truly integrated into the educational process, ITV plays its role outside the process, being put to occasional use as ancillary material. The Commission felt that, with minor exceptions, the total disappearance of ITV would leave the educational process fundamentally unchanged (6, pp. 80-81).

Kittross concluded that much of the ETV research has been redundant and poorly planned, neither asking all the questions nor finding the answers (18, p. 234). However,

all authorities are not so critical or pessimistic. In considering the past decade of television usage by school systems, Wittich asserted that ETV is a dynamic supplement or alternative to traditional instruction. Television presents efficient, quality instruction, compiled by a team of teachers, psychologists, communications specialists, and production crews (33, pp. 46-47). Therefore, television can contribute to education by expanding educational opportunities and increasing educational quality (29, p. 74). Francis Keppel stated that ITV is "evolving into the total education process as it is absorbed into the necessary revolution in education."

SUMMARY

This chapter has surveyed the literature which related to the context, quality, and interpretation of research studies. The ares of concern were disadvantaged children, approaches to teaching elementary science, and instructional television.

The following four factors which operate in the lives of deprived children were described: language factors, learning patterns, readiness for instruction, and school behavior. Riessman's assessment of the strengths and weaknesses of deprived children was cited. Malkin's description of an elementary school science program for children who are culturally deprived was presented in terms of instruction and learning.

In discussing approaches to teaching elementary science, the three major approaches of content, process, and attitude were described. Some attention was afforded the inquiry approach and the arrangements for instructional implementation.

The remainder of the chapter was devoted to a discussion of ITV, examining its history, usage, characteristics, including potentials and limitations, and the research relating to its effectiveness.

Kumata, Holmes, and Schramm reviewed major research cases and reported that the majority of the projects found no significant differences between groups who viewed television and those who did not. Those researchers who reported significant results favoring television viewing found the elementary grade children more responsive than high school students. Science and mathematics were taught most effectively by the television instructors. Other authorities reported equally negative results.

Kittross concluded that ITV research so far has been meaningless and insufficient. However, it is the opinion of such men as Wittich, Gordon, and Keppel that ITV is slowly gaining status as an important educational tool.

Chapter 3

RESEARCH PROCEDURES

Chapter Two surveyed literature related to disadvantaged children; the process, attitude, inquiry, and content approaches to teaching elementary science; as well as research related to the effectiveness of ITV in teaching science. This chapter deals with the procedures undertaken to complete this investigator's research project. The following topics will be discussed: the design and treatment, the study area, materials, and data sources. This study was designed to assess the effectiveness of television as a medium for instructing disadvantaged children.

DESIGN AND TREATMENT

The design required two groups of fifth grade children and two groups of sixth grade children, one group in each grade serving as the experimental group with the other group serving as the control group. The sample was determined as follows: on enrollment day the fifth and sixth grade class memberships were listed in alphabetical order and numbered. One teacher in each grade took all those students whose names fell beside the even numbers while the other teacher in each grade took those names

beside the odd numbers. Later entrants were placed in the classroom containing the fewest number of children. The groups that were designated to be experimental were those who were having science class at the time which corresponded to the television schedule.

The treatment consisted of a direct-teaching, science program telecast once a week supplementary to the classroom instruction. The programs were provided by KETV, a state sponsored educational network.

STUDY AREA

The area studied was that section of urban Hopkinsville, Kentucky, which is served by Virginia Street School. The school organization is for grades one through six, also including one class for the educable mentally retarded. The enrollment of the school averaged 301, 64 percent of which were Caucasian and 36 percent were Negro.

Although this area is partially commercialized, it is still populated by upper-middle, middle, and low-class families. Growth of suburban living has drawn most of the wealthy families away from the downtown area. Many of these houses are now owned by average middle-class people. However, those houses nearer to the business district have been repeatedly sold or rented, generally falling into the hands of the lower-class people who work in the factories or live from money provided by welfare or unemployment checks. Another settlement within this area is a large community of

Negroes who maintain a middle-to-lower class existence. Considering the nature of the district, it is not especially surprising that the school's population is characterized by constant emigration.

When integration laws closed Canton Heights School in the early 1960's, ending its service to the Negroes who live in that area, Virginia Street School absorbed these children into its classes. Both middle and low socio-economic classes of Negroes are represented in the school population. Because the school has been designated by the Office of Health, Education, and Welfare as one serving a disadvantaged area, it qualified to receive the federal teacher's-aid program, the breakfast program, and money to provide free lunches to poverty-stricken children.

MATERIALS

Both control and experimental groups were treated to identical materials and methods, except for viewing the ITV lessons. The fifth grade studied Science in Our World; the sixth grade, Science for Today and Tomorrow, third editions, published by D. C. Heath and Company. Tests that accompanied the textbooks were used as a basis for a testing program.

Since the order of the chapters in the textbooks did not correspond with the sequence of the television series, the books' chapters were sequenced to match the telecasts. The following chapter content was not covered by the two

television series: fifth grade, Chapters 1, 7, 8, 12, and portions of Chapters 2 and 3; sixth grade, Chapters 3, 4, 5, 6, 7, 8, and portions of Chapters 1, 9, and 12. Ten of the twenty-nine lessons in the fifth grade television series dealt with material not covered in the textbook. Of the thirty lessons in the sixth grade ITV series, twenty-one lessons dealt with material not covered in the textbook.

KETV provided each teacher with a teacher's guide to programs, which contained a synopsis of each lesson, suggested warm-ups, follow-ups, and enrichment activities. Mrs. Barbara Coleman taught the fifth grade series "Science Quest" that was purchased from Southwest Texas Educational Council, Austin, Texas. The series is designed to challenge thinking and investigating which would lead to deeper understandings. Lessons One through Five dealt with the scientific method and the characteristics of matter. Lessons Six through Nine discussed electricity, motion, and machines. Lessons Ten through Fifteen considered sound, light, earth's forces, geology, communications. Lessons Sixteen through Twenty-nine dealt with ocean currents, heat, atmospheric pressure, space travel, the animal and plant kingdoms.

The sixth grade series, "Let's Explore Science," was purchased from the Great Plains National Instructional Television Library, University of Nebraska at Lincoln. Mr. Gene Gray and Mr. Peter Taylor alternated teaching responsibilities. According to Gray, the series was concerned with characteristics of matter and change and with

picturing science as a systematized, interconnected body of knowledge obtained by a valid method of investigation. Most of the lessons began with the observation of a phenomenon which essayed questions and a hypothesis to be tested. The emphasis of the series was upon thinking through a problem to learn the methods of science. This series consisted of fourteen units of work that composed thirty lessons, each unit illustrating a tool of the process approach. Although most lessons were open-ended, occasionally a lesson would conclude with an answer. A key objective of the process approach is to teach processes such as observing, measuring, classifying, inferring, predicting, and interpreting. This approach is not textbook or content oriented; that is, it does not deal directly with facts, laws, or theories (17, p. viii). Consequently, by its very nature, this series presented a difficult teaching-learning task--difficult for the students who were totally unaccustomed to this method and for the teacher faced with nothing but a textbook to utilize. Some of this difficulty might be characterized by a student's remark made after spending four weeks watching the television teacher examine crystals: "Hey, didn't we see <u>that</u> last week?"

Trying to coordinate a television schedule with a departmentalized class schedule created many difficulties. Interruptions such as special school programs, the arrival of films, or school dismissals interferred with the viewing of television. The sixth grade had to be scheduled to view

television at a particularly inappropriate time. The only time available which corresponded with the television schedule was a period following their library visit. The class had to rush back from their visit, quickly change classes, receive a very short warm-up, and view the lesson from 1:45 until 2:00. At 2:00 five students left for a remedial lesson while the remainder of the class received the follow-up and a short, twenty-minute science lesson. Therefore, the result was an undesirable schedule.

Additional materials such as filmstrips were used in the science classes. Films from Western Regional Library, South Central Bell, and N.A.S.A. headquarters were used extensively. Books, magazines, pictures, charts, newspapers, N.A.S.A. pamphlets-booklets-and charts, and hobbists' collections were important elements of the classroom environment.

While studying the telephone, the fifth grade witnessed a lecture-demonstration presented by a staff member from South Central Bell. The sixth grade made a trip to the Hardin Planetarium in Bowling Green. Both the fifth and sixth grades received additional conservation lessons once a month in classes conducted by the area conservation officer. The fifth grade classes were given an opportunity to grow seeds treated with radiation in a seed program which is sponsored every year by the University of Kentucky in cooperation with the local 4-H Club. The program was culminated with the viewing of a radiation film.

Items such as a micro-projector, slides, models, dry cells, wires, sockets, and chemicals were borrowed from the high school laboratories so that the children could perform the necessary experiments. An attempt was made to give the children ample opportunity to perform experiments which would illustrate the concepts studied in science.

Commercial television offered occasional educational experiences such as Jacques Cousteau's and National Geographic's specials or other programs on the beaver, prairie, and pollution. When the fifth grade studied a unit on weather, daily weather maps were drawn which reproduced those drawn by Bob Lobertini on Channel 5, Nashville. Using homemade barometers, the class attempted their own weather predictions.

DATA SOURCES

Many types of data were collected in order to best ascertain the effects of ITV upon the learning of science by the fifth and sixth grade subjects. The plan for testing various abilities was based upon these tests: Kuhlmann-Finch Intelligence Test, Stanford Achievement Test, chapter and vocabulary tests over textbook material, post-tests based upon tests published by D. C. Heath and Company. A log book of daily observations was maintained.

Everyone in the fifth and sixth grades who had not taken the appropriate intelligence test, was given the Kuhlmann-Finch by the elementary guidance counselor.

Intelligence data were collected, anticipating that statistical analysis could lend some insight into school success. However, school achievement may reflect the extent to which a child has been exposed to an experience which could promote academic success (8, p. 6). The Kuhlmann-Finch test was administered because this is the test which is used extensively by the Hopkinsville City Schools.

The Kuhlmann-Finch is a battery of eight test booklets planned to cover the range of intelligence from grade one through the high school, each booklet containing five subtests. The first two booklets contain nonverbal tests; the third, one verbal test and four nonverbal tests. In the other five booklets three of the five subtests are in verbal form. With the format following the Kuhlmann-Anderson Intelligence Test, this version is timed but is essentially a power test (5, p. 349). Performance on the test is expressed as "standard IQ" and as mental age, the IQ being based upon the median score on the five subtests. Age units paralleling the Heinis mental growth unit curve were used in the construction of the tests (5, p. 350).

Test validity depends upon principles of procedures used in the selection and placement of test items. Some of these procedures are the following: increase in percent passing with age, homogeneity of test material over the age range, freedom of test items from specific training, emphasis on power, and objectivity in directions and scoring. The major criterion was the regular increase in percent passing

with age. The Kuhlmann-Finch test was originally standardized with a sample of approximately 10,000 children. The range of difficulty in each test was found to be adequate, with the discrimination power of the items high. Both boys and girls did almost equally well on the tests. No correlations with criteria were given because the reviewer believed the tests to be validated sufficiently through their method of construction. Within-age reliability coefficients for ages six to seventeen years range from 0.86 to 0.92 for 110 to 250 samples.

Norms for this test are in terms of median mental ages and intelligence quotients. The median mental age is the chronological age corresponding to the median of the five point scores earned on the subtests. The IQ is a deviation or standard score in a distribution with a mean of one hundred and a standard deviation of sixteen. The test attempts to predict school learning capacity (5, p. 349).

Another evaluative instrument used in the study was the Stanford Achievement Test. The recent edition has batteries for the primary, elementary, intermediate, and advanced levels. Each battery contains from five to nine tests, covering the areas of reading, spelling, language, mathematics, social studies, science, and study skills.

The authors of the tests claim that the content was based upon recent analysis of contemporary textbooks, courses of study, and professional literature in the numerous fields. The science portion of the test consists

of a broad sampling of knowledgeable items (5, p. 76). Every manual presents split-half reliabiltiy coefficients which are corrected by the Spearman-Brown formula for each subject and grade level. Each of these is based on approximately 240 pupils randomly selected from thirty-four school systems. Reliability coefficients approximate 0.85 (5, p. 78).

Test time limits are apparently ample to allow all pupils to finish each part. Speed would be a factor in the performance of only the exceptionally slow.

The authors provide modal-age grade norms for each subject tested. These norms indicate the grade level of the pupils who receive a given average raw score on the test, using approximately 65 percent of the pupils in the grade who are "typical" for their age. These norms allow comparisons of achievement (5, p. 79). For the purposes of this experiment, only the science achievement scores on the Stanford Achievement Test were used in the analyzation of the data.

Another source of data was the test scores obtained during the six-weeks grading period. Vocabulary and chapter tests were constructed by this investigator. Being totally objective in nature, the test items were selected upon the basis of their relevance to the concepts presented in the textbook.

A series of objective tests were designed by this investigator based upon test booklets that accompanied the

science textbooks used by the classes.* The fifth grade booklet contained tests for each chapter which included a battery of multiple-choice, matching, fill-in-the-blank, and discussion questions (2, pp. 1-77). The sixth grade booklet contained identical material (3, pp. 1-77). All parts of the battery were used except the discussion section because the intent was to test objectively simple recall of basic facts and concepts presented in the textbook. The scores obtained from this source were then used as a comparison with regular scores obtained on tests used to determine six-weeks grades.

SUMMARY

This chapter has considered the procedures of research involved in the study organized to determine if any differences in science schievement by fifth and sixth grade children from a low socio-economic background could be realized as the result of viewing a science program taught by ITV once a week. The experiment was designed to use four groups of children, one group in each grade serving as the experimental group while the other group served as the control. The area chosen for the study was an urban elementary school serving mostly lower-income families of both the Negro and Caucasian races.

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Both groups in each grade received as identical instruction as was possible except for the viewing of ITV. Experimental groups viewed an ITV lesson from September through May which was broadcasted by KETV in Lexington, Kentucky.

The instruments for collecting the data were the Kuhlmann-Finch Intelligence Test, Stanford Achievement Test, scored from chapter and vocabulary tests, and tests based upon achievement test booklets published by D. C. Heath and Company.

Chapter 4

EXPERIMENTAL RESULTS

Chapter Three delineated research procedures, discussing the design and treatment, study area, materials, and data sources. This chapter will deal with a discussion of the investigation and recommendations.

DISCUSSION

Data for each of the groups were collected by using the Kuhlmann-Finch Intelligence Test, Stanford Achievement Test, chapter and vocabulary tests, and post-tests based upon test booklets published by the D. C. Heath and Company. To obtain individual data which would be used in the analysis, these methods were employed: each individual's mean was calculated for his chapter tests and for his post-tests scores. The Stanford grade placement science score was calculated for each individual. These three scores were each subjected to separate analysis.

Prior to performing any analysis, the groups were screened to remove all those students who were not present throughout the entire experiment. This screening dropped the number of fifth grade participants to thirty-seven, nineteen of whom belonged to the control group. Of the forty-one participants in the sixth grade, twenty-two

belonged to the control group. To expedite further groupings, the last name from the alphabetized roster of each control group was withdrawn. The membership then consisted of thirty-six in the fifth grade and forty in the sixth grade.

The intelligence groupings were devised by arranging the names of all students in each grade in descending order according to their IQ scores, with the upper 50 percent becoming the High Group and the lower 50 percent being the Low Group. The membership of the experimental and control groups as they were arranged in cells according to IQ scores is as follows:

5th Grade			6th Grade		
	High	Low		High	Low
Experimental	9	9	Experimental	12	7
Control	9	9	Control	8	13
Total	18	18	Total	20	20

The formula that was utilized to analyze the data was a double-classification analysis of variance, chosen because two variables--IQ and ITV--were simultaneously manipulated and because four subclasses were involved. Since some subclasses contained unequal numbers, different formulas were employed. The double-classification factorial design was used with the fifth grade data because the subclasses contained equal numbers (26, pp. 183-85). The basic fact which underlies this technique is that the total variability of a set of scores from several groups can be

divided into two or more categories. There are two categories of variability in this technique: the variability of subjects within each group and the variability between the different groups. The variability of the scores from the total mean is called the total variability. The variability of the scores from their group mean is called the variability within groups, while the variability of the group mean from the total mean is called the variability between groups (26, p. 149).

The following list of symbols and definitions will apply to all references cited in the remainder of this chapter:

$\bar{X}_{tot}$ - the mean of all scores in the experiment

g - a general expression for any group

N_{tot} - a general expression for the number of scores in the entire experiment

N_g - the number of scores in any group

k - the number of groups

ΣX_{tot} - the sum of all the scores in the experiment

ΣX^2_{tot} - the sum of all the squared scores in the experiment

SS_{tot} - the sum of the squared deviations of every score from the mean of all the scores in the experiment

SS_{wg} - a combination of sums of squares within separate groups

SS_{bg} - value based upon the squared deviation of each $\bar{X}g$ from $\bar{X}_{tot}$

MS - mean square, a concept of variance either between groups (MS_{bg}) or within groups (MS_{wg})

Variable R - treatment factor

Variable C - intelligence factor

df - degrees of freedom, the amount of variance in the form of the distribution of the sample

F-ratio - a numerical expression of the relative size of MS_{bg} and MS_{wg}

F.E. - Frequency Expected

F.O. - Frequency Observed

Application of the analysis of variance technique to the data from a double-classification factorial experiment allows three statements to be made about the results: (1) the main effects on the response measure of the different conditions of Variable R, (2) the main effects of the different conditions of Variable C, and (3) the joint effects or interaction of Variables R and C (26, p. 175).

In performing an analysis of variance, the total sum of squares is calculated for all the subjects in the experiment. Then this total sum is broken into its two components: SS_{bg} and SS_{wg}. The following is the computational formulas for these three steps:

$$SS_{tot} = (\Sigma X^2)_{tot} - \frac{(\Sigma X)^2_{tot}}{N_{tot}}$$

$$SS_{bg} = \sum_{g} \left[\frac{(\Sigma X_g)^2}{N_g} \right] - \frac{(\Sigma X)^2_{tot}}{N_{tot}}$$

$$SS_{wg} = SS_{tot} - SS_{bg}$$

The SS for Variable R is determined by this formula:

$$SS_R = \frac{(\Sigma X_{RI})^2}{N_{RI}} + \frac{(\Sigma X_{RII})^2}{N_{RII}} - \frac{(\Sigma X)^2_{tot}}{N_{tot}}$$

This formula is calculated by summing the scores of all the individuals tested under the treatment condition in the experimental (RI condition) and control (RII condition) groups.

The SS for Variable C is determined in a parallel manner by summing the scores of all individuals tested under the intelligence factor in the High (CI) and Low (CII) Groups. The formula is as follows:

$$SS_C = \frac{(\Sigma X_{CI})^2}{N_{CI}} + \frac{(\Sigma X_{CII})^2}{N_{CII}} - \frac{(\Sigma X)^2_{tot}}{N_{tot}}$$

The SS for interaction (SS_{RxC}) is obtained by subtraction: $SS_{RxC} = SS_{bg} - SS_R - SS_C$ (23, pp. 183-86).

In order to handle the unequal numbers in the subclasses of the sixth grade data, another variation of the double-classification analysis of variance formula was employed (11, p. 321-22). This formula is based upon adjusted cell sums. Adjusted cell sums are calculated with this formula, where F.E. is the expected frequency and F.O. is the observed frequency:

$$\text{adjusted cell sum} = \Sigma X \left[\frac{F.E.}{F.O.}\right]$$

The scores of all the individuals tested under the treatment condition in the experimental and control groups were summed and calculated with this formula:

$$\text{Rows} = \sum \left[\frac{(\Sigma X_R)^2}{N_R}\right] - \frac{(\Sigma X_{tot})^2}{N_{tot}}$$

The scores of all individuals tested under the intelligence factor in the High and Low Groups were summed and calculated with this formula:

$$\text{Columns} = \sum\left[\frac{(\Sigma X_C)^2}{N_C}\right] - \frac{(\Sigma X_{tot})^2}{N_{tot}}$$

The within cells formula is based upon adjusted X^2 data and adjusted X data in both rows and columns.

$$\text{Within Cells} = \sum^{R}\sum^{C}\left[\Sigma X\left(\frac{F.E.}{F.O.}\right)\right] - \sum^{R}\sum^{C}\left[\frac{(\Sigma X)^2}{F.E.}\right]$$

The interaction formula employs values obtained in calculating the preceding three formulas.

$$\text{Interaction} = \sum^{R}\sum^{C}\left[\frac{(\Sigma X)^2}{F.E.}\right] - \sum^{R}\left[\frac{(\Sigma X_R)^2}{N_R}\right] - \sum^{C}\left[\frac{(\Sigma X_C)^2}{N_C}\right] + \frac{(\Sigma X_{tot})^2}{N_{tot}}$$

The total sum of squares is obtained by calculating with this formula, employing values obtained previously.

$$\text{Total} = \sum^{R}\sum^{C}\left[\Sigma X\left(\frac{F.E.}{F.O.}\right)\right] - \frac{(\Sigma X_{tot})^2}{N_{tot}}$$

Once the fifth and sixth grade data were treated to the preceding formulas, the mean (MS) for each of these sources of variability could be found. The MS's are found by dividing each SS by its degrees of freedom. The following formulas are used to compute MS (26, p. 186). For the fifth grade data - $MS_R = \frac{SS_R}{df_R}$, $MS_C = \frac{SS_C}{df_C}$, $MS_{RxC} = \frac{SS_{RxC}}{df_{RxC}}$, and finally $MS_{wg} = \frac{SS_{wg}}{df_{wg}}$. For the sixth grade data the same method was utilized to compute MS.

Finally, the F-ratios are computed by dividing the MS's for R, C, and RxC interaction by MS_{wg} (26, p. 187). $F_R = \frac{MS_R}{MS_{wg}}$, $F_C = \frac{MS_C}{MS_{wg}}$, and $F_I = \frac{MS_{RxC}}{MS_{wg}}$. Each F-ratio is evaluated by comparing it with the value of F at the 5 percent level of significance associated with the appropriate df's, as listed in a Values of F Table. If a given F exceeds the required F at the 5 percent level, the null hypothesis of this experiment can be rejected at that level. However, if the F falls short, the hypothesis is accepted (26, p. 190).

The analysis is concluded by applying chi square (χ^2) to determine whether or not the frequencies observed in a sample depart significantly from expected frequencies. The formula for χ^2 is: $\chi^2 = \frac{(O-E)^2}{E}$, where O equals observed frequency and E equals the expected frequency. If it is found that values of χ^2 as large as or larger than the value obtained would occur by sampling error only 5 percent of the time, the hypothesis is rejected at the 5 percent level of significance. The chi square formula was applied to the sixth grade data only because of its unequal subclasses (26, pp. 196-97).

Having discussed the techniques involved in the type of trend analysis used in this experiment, the remainder of this chapter will describe the results and recommendations.

RESULTS

A summary of the results of the trend analysis of the fifth and sixth grade data is presented in Tables 1 through 3. The result of the analysis of the fifth and sixth grade chapter test scores indicated that only the intelligence factor had a significant effect upon grades earned at the 5 percent and 1 percent level. Analysis also indicated that viewing television had no significant effect upon grade achievement at the 5 percent level.

The values obtained from the analysis of the fifth and sixth grade post-test data proved the intelligence factor to be significant at the 5 percent and 1 percent level. Again, the viewing of television indicated no significant effect at the 5 percent level.

After analyzing the fifth grade Stanford Achievement Test science scores, a slight difference in the experimental mean and control mean was discovered. Although the data analysis indicated that the experimental group achieved better than did the control, it is the assumption that this achievement cannot be attributed to the viewing of ITV. The control group was administered the test under unequal and unfavorable testing conditions, that is, administered by another instructor late in the school day after a long series of previous testing. This fact was unknown to this investigator at the time of its occurrence; therefore, no control could be exercised over the situation. Each of the

Table 1

Summary of Analysis of Variance of Chapter and Vocabulary Tests for 5th and 6th Grades

	Source of Variance	SS	df	MS	F
5th Grade	Treatment (SS_R) ITV or no ITV	3.34	1	3.340	0.065
	IQ (SS_C)	756.25	1	756.250	14.669**
	Interaction (SS_{RxC})	12.27	1	12.270	0.238
	Within Groups (SS_{wg})	1649.78	32	51.556	
	Total	2421.64	35		

	Source of Variance	SS	df	MS	F
6th Grade[a]	Treatment (Rows) ITV or no ITV	7.239	1	7.239	0.047
	IQ (Columns)	1098.241	1	1098.241	7.089**
	Interaction (RxC)	39.506	1	39.506	0.255
	Within Cells	5577.190	36	154.922	
	Total	6722.176	39		

*value of F at the 0.05 level **value of F at the 0.01 level
[a]chi square equals 2.506 with probability > 0.05

Table 2

Summary of Analysis of Variance of Post-Tests for 5th and 6th Grades

	Source of Variance	SS	df	MS	F
5th Grade	Treatment (SS_R) ITV or no ITV	0.029	1	0.029	0.005
	IQ (SS_C)	90.251	1	90.251	16.412**
	Interaction (SS_{RxC})	1.360	1	1.360	0.247
	Within Groups (SS_{wg})	175.999	32	5.499	
	Total	267.639	35		
	Source of Variance	**SS**	**df**	**MS**	**F**
6th Grade[a]	Treatment (Rows) ITV or no ITV	13.425	1	13.425	2.029
	IQ (Columns)	82.250	1	82.250	12.430**
	Interaction (RxC)	6.817	1	6.817	1.030
	Within Cells	238.218	36	6.617	
	Total	340.710	39		

*value of F at the 0.05 level **value of F at the 0.01 level

[a]chi square equals 2.506 with probability > 0.05

Table 3

Summary of Analysis of Variance of Science Grade Placement Scores from Stanford Achievement Test for 5th and 6th Grades

	Source of Variance	SS	df	MS	F
5th Grade	Treatment (SS_R) ITV or no ITV	10.241	1	10.241	7.52**
	IQ (SS_C)	17.922	1	17.922	13.168**
	Interaction (SS_{RxC})	3.736	1	3.736	2.745
	Within Groups (SS_{wg})	43.547	32	1.361	
	Total	75.446	35		

	Source of Variance	SS	df	MS	F
6th Grade[a]	Treatment (Rows) ITV or no ITV	0.230	1	0.230	0.078
	IQ (Columns)	36.962	1	36.962	12.496**
	Interaction (RxC)	19.064	1	19.064	6.445*
	Within Cells	106.495	36	2.958	
	Total	162.751	39		

*value of F at the 0.05 level **value of F at the 0.01 level

[a]chi square equals 2.506 with probability > 0.05

Stanford tests were administered by the homeroom teacher; however, the other three teachers maintained a similar testing schedule. In analyzing the sixth grade Stanford scores, again the only significant value was the F_C, indicating that television made no significant difference in achievement scores.

Therefore, the statistical analysis of all the data collected in this investigation led to an acceptance of the null hypothesis at the 5 percent level of significance. There was no significant difference in measured achievement between fifth and sixth grade children who viewed ITV and peers who did not view ITV as a part of their science instruction. These samples from a low socio-economic population schieved successfully on the basis of their intelligence rather than on the basis of the instructional method employed.

RECOMMENDATIONS

It is the recommendation of this investigator that some advantageous utilization of ITV can be achieved provided the proper method and appropriate level of instruction is employed by the television series and provided an adequate schedule can be arranged for the viewing of the series. These factors are apparently the primary keys to effective utilization of the television medium with the disadvantaged children. If these standards cannot be met, then these children will profit more from

efficient classroom instruction which employs the use of experiments, actual objects, field trips, and instructional aids such as films, filmstrips, pictures, and records.

The open-ended, inquiry approach employed by the sixth grade series appeared to be the less successful of the two series viewed during the experiment in terms of student reaction. The class grew weary of the endless number of lessons which to them appeared to be performing repetitive experiments. They indicated a lack of association of the inquiry process to the goals set forth in the textbook; that is, the television period was seen more as an interlude during the day, not as a particular involvement in the total process of the science instruction.

Whenever the fifth grade series corresponded in topic with the textbook material and when the lesson involved more than just lecture and ordinary classroom experimentation, the class paid the closest attention. If the instructor brought in unusual objects or provided any experiences which could not be accomplished by the classroom teacher, the lesson was more successful. However, if the instructor did nothing more than what the classroom teacher could do, the value of the television lesson was lost for these children. Furthermore, one of the major disadvantages of this series for deprived children was the sophistication of experimental technique and terminology. Many of the lessons involved techniques, terminology, or concepts far too advanced for these students' comprehension. Therefore,

the major recommendation is that the television series must be appropriate in its level of instruction, not instructing with advanced technique, terminology, or concepts which are above the comprehension of these deprived children.

SUMMARY

Employing data obtained from the Stanford Achievement Test, chapter tests, post-tests, and IQ scores, a double-classification analysis of variance was utilized to determine any significant differences in achievement between control and experimental groups in an experiment to determine the effectiveness of ITV in the instruction of disadvantaged children. The thirty-six fifth grade and the forty sixth grade children were each divided into High and Low Groups, based upon their intelligence scores. Two types of variance factorial designs were used because of equal subclasses in the fifth grade and unequal subclasses in the sixth grade.

Statistical analysis of the group data led to the acceptance of the null hypothesis at the 5 percent level of significance, indicating that these samples from a low socio-economic population achieved successfully on the basis of their intelligence rather than on the basis of the method of instruction employed.

It is recommended that some advantageous utilization of ITV can be achieved provided that the series presents valuable experiences which cannot be done by the classroom

teacher, provided that the level of the instructional technique, terminology, and concepts is not more advanced than the comprehension level of the students, and provided that an adequate viewing schedule can be arranged.

Chapter 5

SUMMARY

The purpose of this investigation was to determine if there was a statistically significant correlation between the use of ITV as a learning supplement in science instruction and achievement scores of socio-economically deprived children. The basis for such a study was the need to describe and empirically examine the effects of ITV on pupil achievement. Knowledge related to the effects of educational technology could serve as a basis for making instructional procedure changes. Such changes are indeed imperative as a response to critical problems in today's schools.

The research hypothesis states that there is no significant difference in measured achievement between the fifth and sixth grade children who viewed ITV and the peers who did not view ITV as a part of their science instruction. The significance level of 0.05 was used as the criterion for evaluating the acceptance of the hypothesis. The study was limited to Caucasian and Negro children who came from urban middle-and lower-class families in Hopkinsville, Kentucky. These children attend Virginia Street School, which is classified by the Office of Health, Education, and Welfare as one serving a "disadvantaged" area. The period of study

coincided with the initiation and termination of the science series broadcasted by KETV, Lexington, Kentucky, from September 9, 1969, through May 14, 1970. The learning principle upon which this investigation was based is that learning is associated with the presentation of visual and auditory stimulation or with responses evoked by these stimuli (4, p. 238). Definitions of terms such as "disadvantaged," "intelligence," "instruction," and "educational television" were discussed and operationally defined.

In the survey of the literature, the areas of concern were disadvantaged children, approaches to teaching elementary science, and ITV research. Language factors, learning patterns, readiness for instruction, and school behavior are four factors which operate in the lives of deprived children. A description was given of a science program for culturally deprived children which was designed by Malkin.

In discussing approaches to teaching elementary science, the three major approaches of content, process, and attitude were described. Some attention was afforded the inquiry approach and the arrangements for instructional implementation.

The discussion of ITV centered about the examination of its history, usage, characteristics, including potentials and limitations, and the research relating to its value as an instructional tool. Kumata, Holmes, and Schramm reviewed

major research cases and reported that the majority of the projects found no significant difference between groups who viewed television and those who did not. Those researchers who reported significant results favoring the viewing of television found that the elementary grade children were more responsive than high school students and that science and mathematics instruction were taught more effectively. However, other authorities reported equally negative results. Kittross concluded that ITV research, so far, has been meaningless and insufficient. It is the opinion of such men as Wittich, Gordon, and Keppel that ITV is evolving into a most important instructional tool.

The design of this investigation required two groups of fifth grade children and two groups of sixth grade children, one group in each grade serving as the control group with the other group serving as the experimental group.

Both control and experimental groups were treated to identical materials and methods, except for the viewing of the ITV. The fifth grade group viewed "Science Quest," distributed by the Southwest Texas Educational Television Council, Austin, Texas. The sixth grade group viewed "Let's Explore Science," distributed by the Great Plains National Instructional Television Library, University of Nebraska, in Lincoln. All groups were given ample opportunity to grow in science understanding through the use of field trips, local resource people, experiments, and various audio-visual aids.

The instruments for collecting the data were the Kuhlmann-Finch Intelligence Test, the Stanford Achievement Test, scores from chapter and vocabulary tests, and tests based upon achievement test booklets published by D. C. Heath and Company.

A double-classification of analysis of variance was utilized to determine any significant differences in the achievement between control and experimental groups in this investigation. The thirty-six fifth grade and the forty sixth grade children in attendance throughout the entire experiment were divided into High and Low Groups, based upon their IQ scores. Two types of variance factorial designs were used because of equal subclasses in the fifth grade and unequal subclasses in the sixth grade.

Statistical analysis of the group data led to the acceptance of the null hypothesis at the 5 percent level of significance, indicating that these samples from a low socio-economic population achieved sucessfully on the basis of their intelligence rather than on the basis of the instructional method employed.

It is recommended that some advantageous utilization of ITV can be achieved provided that the series presents valuable experiences which cannot be accomplished by the classroom teacher, provided that the level of instructional technique, terminology, and concepts is not more advanced than the comprehension level of the students, and provided that an adequate viewing schedule can be arranged.

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