# EFFECTIVENESS PARAMETERS FOR THE USE OF EDUCATIONAL TELEVISION FROM SPACE AS A SUPPLEMENTAL CURRICULAR DEVICE

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To My Parents:

Merrill E. and Marion Chancer Joëls who never let me walk alone, materially or spiritually.

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You know, I still have no clue as to the roots of that Russian

proverb. But one thing I have learned from this experience, indeed, whatever love is, and much has been expressed towards the writer, it is definitely not a potato.

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## CHAPTER I

## INTRODUCTION

The United States of America is preparing to launch an orbiting Space Laboratory called Skylab. This may well be the premier acheivement of American Science and technology of the 1970's. Skylab, unlike the Apollo Lunar Missions, is involved in long duration space flight. Missions to the Moon's surface have a time span of approximately fourteen days, following the success of the Apollo Lunar Exploration Program, Skylab will turn its attention to newer emphasis in space exploration. Skylab will be a test of man's ability to live in space for long periods of time. Skylab's operations will involve activities in Earth orbit, and Skylab will provide a formal laboratory in space.

The large number of experiments onboard Skylab involving studies of the Earth, the Galaxy, the Sun, and Man himself, provide overlapping material for all of the divisions of scientific study in the modern curriculum. In addition, television facilities will be available on Skylab to transmit pictures of activities and experiments to the ground. With proper planning, activities photographed on Skylab could become valuable curricular supplements. The long period of operations, i.e. three missions of one, two, and two months each, affords a great many opportunities to capture the Skylab astronaut and experimental activities and transmit these to earth for use in an educationally meaningful way.

Beginning with the Gemini program, efforts were made to broadcast some brief demonstrations in zero gravity that might be of interest to the schools. This was continued for the Apollo flights and several brief programs resulted. The Educational Programs Division of NASA provided consultation and input of ideas for some of the Apollo Educational TV segments. In addition, Aerospace workshops for teachers have produced a group numbering in the tens of thousands of teachers anxious for further aerospace input into their classrooms. Reception of TV programs from Skylab, on a regular and organized basis, would provide valuable real time input for the Aerospace Education programs currently being undertaken in many school districts nation wide.

Space Science Education Project personnel under the direction of the NASA Educational Programs Division have recognized the need for direct classroom involvement in the explorational facet of space travel. To this end, the Educational Programs Division has developed a complete Skylab Education Project involving teacher preparation, student experimental participation, supplementary lectures and visual materials, planned film activities, and, of course, Skylab Educational Television. The Skylab Educational Television will be a "real time" public involvement feature of the Skylab missions. This will provide the school with something long sought: direct involvement into scientific and technological activities. It will also serve to involve the students directly with the total Skylab program.

## Statement of the Problem

The principle objective of this study was to field test possible instructional television programs from space for use as a curricular supplement. For comparative purposes a simulated space program is compared to a conventional educational television program identical in subject matter, content, and length. In addition, descriptive data were gathered to provide information about the content of the programs, general attitudes toward science, and the form and presentation of educational television from space.

An important objective of the study was to identify and critique data collection techniques which do not impinge greatly on either the teacher or the classroom situation. Often the replicability of a study is impaired or even impossible due to the nonreplicability of the data collection techniques.

## Significance of the Study

Much emphasis has been placed in our society upon making the curriculum more relevant, more applicable to the students needs. An important part of this movement will be the motivation of students to participate in the curricular experiences. Students are becoming system aclimatized and often seem to be learning in spite of rather than because of, the school experience.

Bringing the world to the classroom forces the student to participate in society and arms him with first hand experience for making decisions as a citizen. The findings in this study fit, in a small way, into this operational framework. The National Aeronautics and Space Administration recognizing the opportunity for student involvement is embarking on an active program of educational effort. This will be initiated prior to, during, and after the flight of the Skylab Space Station in 1973-74. NASA will provide television from the

Skylab, background film data relating to Skylab, its astronauts, and its experiments, and is attempting to provide comprehension of the scientific and human principles involved in this space effort rather than documentation which has been the emphasis in the past.

Qualitative and quanitative information from the experimental and descriptive portions of this study provide developmental guidelines for further application of educational television from space. Implicit in the construction of this study was a complete survey of the television production capabilities of the Skylab system and foundation work for integrating future flights and other NASA programs into the mainstream of the educational curriculum. If successful, efforts of this type, undertaken by other agencies, i.e. those responsible for oceanographic research, may provide a key with which to open the door of real science experience and career possibilities for the students in today's elementary and secondary education.

The preparation of future scientists to advance and continue our research programs is facing serious difficulties. Perhaps this is due to the fact that science teaching, in the lower grades where career motivation is generated, is controlled and dictated by the University. As Weinberg (35) stated:

> The professional purists, representing the spirit of the fragmented, research-oriented university, got hold of the curriculum reform, and by their diligence and aggressiveness, have created puristic monsters.

Failure to motivate new scientists may become critical in a society equiping itself for vast scientific investigation and technological achievement. Laurel N. Tanner (32) is involved with the problems of the science curriculum as a motivator to seek scientific careers.

> Learners, including the most able in science, are more likely to be motivated to seek scientific careers if they can see the use of science for society. The dissociation of science from human affairs can hardly be considered a curricular attraction when growing numbers of students are seeking careers which offer personal fulfillment through the mitigation of human suffering. The science curriculums do not allow for humane reflections.

Critics of contemporary secondary science curricula down grade the discipline related nature of science instruction. In 1959 we find the President's Science Advisory Committee stressing the need for science courses to interrelate with one another. Perhaps the lack of relevance in science curricula and the lack of interdisciplinary association are not the only causes for the diminishing number of career enrollees in scientific professions, but writers in this area deem them among the most important factors.

Naturally, science educators and the scientific community are looking for answers for their manpower needs. As long as science continues to be a series of monolithic disciplines the interrelationship of science and life will be difficult to communicate. A simple curricular approach for the solution to the problem of scientific irrelevance may well be the infusion of real time scientific investigation into the classroom. Any of the major areas of scientific or technological progress provide excellent examples for the interdisciplinary nature of science.

Perhaps the epitome of scientific integration comes in the areas of man's exploration of the world in which he lives. In learning about his world and his universe man has been forced to integrate biological, physical, and chemical concepts into giant conceptual schemes. These form the basis for the theories with which he pushes his investigations onward. It would be natural therefore to involve the students with the nature and problems of fundamental research. One of the most vital and intrinsically interesting studies man is pursuing is research in the area of outer space. With extended space missions relying heavily on all areas of the physical sciences, an opportunity is afforded to experiment and utilize these scientific activities to supplement and augment the existing science curricula.

This study is also the first effort for evaluating live and pre-recorded television from space as a teaching device.

## Hypotheses

The problem of evaluation of the Skylab Television program through comparison with the studio version and evaluation of the opinions of the students is best approached through the formulation of precise research hypotheses. The hypotheses of the study are as follows:

1. There is no significant difference in achievement between the SETV and ETV groups as measured by the differences in their scores on the two test instruments (0.05 level of confidence).
2. There is no significant correlation between male and female students and their achievement on Test I and Test II.
3. There is no significant correlation between urban and rural location and their achievement on Test I and Test II.
4. There is no significant correlation between students receiving Treatment 1 and students receiving Treatment II based on achievement on Test I and Test II.

The results of the statistical treatments may be applied only to the experimental portion of the study. It is also necessary, however, to direct attention and provide a basis for the examination of the descriptive data. To this end a set of research questions was formulated.

## Research Questions

1. Is there a general trend of favorable opinion formulated by the students as to the effectiveness of the television programs?
2. Is there a general positive opinion formulated by the students as to the relevance and subject matter of the programs.
3. Is there a general positive opinion expressed by the students concerning general attitudes towards science?

Since no statistical justification will be offered for acceptance or rejection of these questions, the author will offer only significant percentages of agreement or disagreement as a basis for qualitative evaluation of these research questions.

## Operational Definitions

1. SETV: Skylab Educational Television - Skylab Educational Television consists of video material photographed on and from the Skylab Space Station. For use in this study the material has been simulated in Skylab training mockups and employs photography taken from space on earlier orbital missions.

2. ETV: Educational Television - Educational Television may be defined as conventional instructional television involving the use of a T.V. teacher and appropriate visual aids and auxillary production

devices used to convey instructional material.

3. Urban Schools - As used in this study urban schools defines schools within the Tulsa School District.

4. Rural Schools - Within this study rural schools are defined as those participating schools in districts other than those in the Tulsa school district, N.B. the Tulsa school district contains a minimum of five times the number of students contained in the rural school districts.

5. EREP: Earth Resources Experiment Package - The EREP package includes those experiments on Skylab dealing with the study of Earth from space. This is part of the earth resources program.

## Assumptions of the Study

The following are major assumptions fundamental to this study:

1. There is an equal prior exposure and base level of knowledge for each classroom unit to receive the treatments, N.B. this is basic for post test only designs.
2. That the instruments used meet face and content validity criteria.
3. That SETV quality is representative of actual possible SETV real time programming.
4. ETV quality is consistent with acceptable educational television production procedures..
5. Professional integrity is maintained in the production of both television treatments.
6. The investigator can randomize the treatment which various groups will receive and keep groups within the same school

uncontaminated.

## Limitations of the Study

Conclusions of this study may be limited by the following conditions:

1. This study includes only students enrolled in 10th grade level biology classes.
2. This study includes only urban schools in the Tulsa district.
3. The rural school districts include classrooms from schools in North Central Region 5 of the State of Oklahoma Television Distribution Center who responded to a letter of invitation to participate. Invitations to participate were sent only to those schools within Region 5 which met two criteria:
    1. They had a high school.
    2. They had had an operational video-tape recorder and monitor within the system active during the period immediately prior to the study.
4. The design called for the administration of the treatments in one classroom period. Hence, no attitudinal change can be measured.
5. The possibility of a Hawthorne effect may exist. Replications of this study, however, over a long period of time will be needed to confirm or refute this factor.

# CHAPTER II

# REVIEW OF THE LITERATURE

## Introduction

Approaching this study the investigator was armed with a large quantity of technical data concerning the structure and operation of the Skylab Space Station, the operation and limitations of its television system, the nature of picture quality, and the transmission capability of the flight hardware. In addition, the activities onboard Skylab including all of the crew's everyday operations and all of the experiments had been sifted through, catagorized, and evaluated for educational interest and content orientation. The aim of assembling this information was to provide television programs of interest and value to the schools.

It was apparent from the literature that such devices created from Skylab television output would be intrinsically interesting for students. Much of the time of curriculum planners over the past decade has been devoted to curricular reform, augmentation, and supplementation. In addition to the search of related curricular literature, the investigator continued with his examination dealing with the nature of television as a teaching instrument and evaluative parameters for constructing new television teaching devices.

## Backgrounds to Curricular Reform and Supplementation

Perhaps the most misused word in education today is curriculum. Each educator, teacher, administrator, and parent has a different idea of what the curriculum is and what the goals of the curriculum should be. Curriculum planners and consultants often try to have the teachers and administrators assess the needs of the community, the school, and the students and from these derive basic curricular objectives. From these objectives, specific outlines of material and styles of teaching should follow, and the teacher can then adapt these to his own particular style and course structure.

The area of curricular supplementation falls under the category of curricular reform. Curricula in the past have tended to be monolithic in nature and homogeneous in approach. There is a nation wide movement, however, to alter the curriculum in such a way as to better meet the needs of the local community. Curriculum is more and more being seen as a functional entity to be used and changed. Wilhelms (36) gives a perceptive insight into the applied nature of the word curriculum when he defines it as follows:

> A curriculum is what a teacher uses when he teaches children. Some of a curriculum may also be, as common parlance has it, 'what one teaches,' for some items of subject matter will be retained and used in about the way they were taught. That is to say, in these cases, learning and using the content itself may actually be the goal. Yet, in general, a curriculum is far less 'what one teaches' than it is 'what one teaches with.'

The greatest impact on curriculum, until recently, has been through external pressure. In science education, for example, a series of external stimuli may be traced which resulted in serious and extensive curricular reform. It may be observed that in the years immediately following World War II scientists gained both stature and conscience, both attributable to the success of the atomic age. The schools were slow to react, however, and science teaching remained, for the most part, in a state of equilibrium. The great surge of curricular reform in science education came immediately following the dawning of the Space Age in late 1957. Educators at that time saw Sputnik as a monumental example to the ineffectiveness and nonproductiveness of our school system in developing oriented and motivated future scientists. Sputnik was perhaps the impetus for extensive scientific curricular reform, but the reform was already underway when news of Sputnik was received. The basic curricular reform in the areas of mathematics and sciences had begun in the middle fifties at the University of Illinois, M.I.T., and at the Woods Hole Conference. By the middle sixties the movement had grown to tremendous proportion. Clinchy (7) observes:

> As of this moment, there is hardly any field that has not felt the impact of this wave of reform. Almost everyone of the traditional scholarly disciplines has a committee exploring the possibility of revising the teaching of its subject in the schools or of introducting the subject if it is not already being taught.

Clinchy identifies what he calls common tendencies or similarities that are present in the "most significant and influential programs." These may be summarized as follows:

1. The new curricular programs typically involve--and in most cases have actually been started by--men who are among the best minds a particular discipline has to offer.
2. The new programs tend to be national in scope and to be

supported on a large scale.

3. The first step in the important reforms has been for the scholars to decide what is to be taught.
4. Every significant reform has involved a deliberate effort to bring the curriculum up to date.
5. The current reforms almost always involve not only a radical approach to the content but also explorations into new and different ways of teaching and learning.
6. The new programs almost always include the production of actual educational materials.

Clinchy also observes the importance of relevance and flexibility on the part of the school. He sites several examples of radical curricular proposals:

> The object of these men is not to startle but to expose children only--or at least primarily--to material that is relevant to the contemporary world and to the lives the children lead in it, material that is honest and honestly reflects the state-of-the-art in whatever field happens to be under study.
>
> It is for these reasons that the more imaginative programs always seem to be radical revisions. In most cases they do depart radically from what is taught now, both in content and in spirit. But this appearance of radicalism comes not so much from any desire on the part of the scholars to be bold and brash. It is due more to the simple fact that our school programs have been allowed to fall so far behind that catching up requires drastic changes in what is taught.

Corroborating Clinchy's second common tendency of major curricular reforms John Goodlad (14) observes:

> If the current movement is to be self renewing... innovative curriculum projects and processes must be built into the broad political structure of federal, state, and local curriculum planning.

There are several aspects of curriculum reform which bear directly on the generation of new curriculum supplementation. Of great importance is the need for evaluation and feedback from each new attempt to reform the curriculum. Frymier (9) observes:

> There is no aspect of the system which regularly generates evaluative data, nor is there anything in the concept which requires that the system pay attention to the feedback if it should appear.

This emphasizes the need for research and evaluation of each new device or curricular reform. Frymier may be challenged in the future and we may find that the "system" will pay attention to research feedback due, not to the development of research consciousness or an ethical code, but rather to the new darling of parents and administrator's, accountability. Receptivity to such feedback would be a positive step in the development and selection of curricular supplements and general curricular reforms.

Another danger inherent in curricular reform is to provide high motivation for students with little beneficial developmental follow-up. Sizer (30) states:

> Too often curriculum development has been so overwhelmed by this phenomenon that the 'development' seems to consist simply of a series of experiments designed to give the instructor his 'gee-whiz' kick. The kids like this, and the teachers too, but there are more profound questions that we all should be asking.

The "gee-whiz" effect is not new to aerospace education. Like the Atomic Energy Commission, NASA has, for the past decade, been basking in the sunlight of outstanding scientific achievement. Teaching devices or visiting programs, i.e. the Space Science Education Project Spacemobile operations, have noticed a "gee-whiz" effect and so additional curricular materials have been provided for follow-up and additional development. This, then, is of primary concern in developing curricular supplements from Skylab. Follow-up and additional materials for the teachers will be necessary if Skylab curricular supplements are not to be merely "gee-whiz" exercises.

The third major area of concern in developing curricular supplements deals with the student. One of the common tendencies that Clinchy omitted was the fact that most of the major science curricular reforms were based on or rooted in a particular learning theory, the most prevelent being those of Piaget (28), Gagne (10), and Bruner (4). With all of the learning theories, however, still no one is sure what it is or how it is that a student performs that operation we call learning. Developing curricular supplements we tend to think in terms of devices which are, in actuality, stimuli. It is hoped that these stimuli will produce what is called learning experiences. Tyler (34) defines these as follows:

> The term 'learning experience' refers to the interaction between the learner and the external conditions in the environment to which he can react.
>
> This definition of experience as involving the interaction of the student and his environment implies that the student is an active participant, that some features of his environment attract his attention and it is to these that he reacts.

The importance of this to the total curriculum is emphasized by Taba (31).

> Selecting the content, with accompanying learning experiences, is one of the central decisions in curriculum making, and therefore a rational method of going about it is a matter of great concern.

Taba goes on to establish some criteria for selecting curricular learning experiences. Notably she feels that:

> Effective knowledge of the current world requires more than familiarity with place names. In addition, the extension of the objectives of education has called for new areas of learning which were not part of the classical curriculum....

Curricular supplements must therefore fill these gaps in the classical curriculum providing information about the new areas of learning. Taba offers a guideline for the future development of the curriculum, and implies methodologies and responsibilities that will result from curricular development and supplementation:

> Finally, an improved educational technology presumably permits an expansion of what can be learned in a given period of time. New technical aids for self-teaching, for communicating information, and for learning a variety of skills are shifting the balance of time and of effort needed for acquiring a substantial portion of the current curriculum. These developments call for a reconsideration of what it is possible to offer and a re-evaluation of the scope of objectives for which the school can be responsible.

Taba's emphasis on the use of educational technology and new technical aids is a significant one. It introduces one of the key elements of curricular reform: variety of learning stimuli. Different media techniques enhance different subject matter and different approaches. Selection of appropriate media techniques has been, and will continue to be, one of the backbones of curricular reform and supplementation.

## The Role of Educational Television

Of primary concern for this study is the nature of foregoing research in the area of educational television, guidelines for the use of educational television in curricular supplementation, and limitations of educational television as an instructional device. A great deal of literature exists over the topic of educational and instructional television. This review will limit itself, however, to specific authors from which information significant to this study was deduced.

Parameters for the use of educational television have been established by a large group of research studies. McKeachie (20) provided one of the earliest critical reviews of educational television. He felt that the primary advantage of using television was not to replace the classroom teacher, but rather to deal with very large numbers of students. He found very slight differences between television and conventional instruction. It should be noted that McKeachie's work at that time was based on television designed as an electronic means for "canning" or preserving lectures. He summarizes his findings as follows:

> Note that most research has dealt with television as a substitute for conventional instruction. The potential of television as a tool for enriching classroom teaching has not been assessed.

A second classic review was undertaken by Chu and Schramm (6). The major aspects of their review are of the greatest importance in planning televised curricular supplements. Among the conclusions cited by Chu and Schramm are the fact that television becomes less effective as the grade level of the student increases; that television is successful in one way communication; that television works best where classroom activities accompany its use; that screen size makes little difference; and that good planning and organization are necessary for successful use of educational television. Schramm and Chu cite several production considerations all of which were observed in preparation of the television devices for Skylab Television and the studio version. These include:

1. There is no evidence that any one production technique produced more learning than any other production technique.
2. Attention getting devices that are irrelevant to the subject matter will most probably impede learning.
3. Pausing in the program at strategic times will most probably increase learning and live teacher follow-up is also encouraged.
4. Distance from the screen and width of the viewing angle are critical when a clear perception of images is required (sic).
5. The size of the viewing groups seems to have no effect upon learning.
6. Motivation is critical to the effectiveness of instructional television.

Surveying a great number of studies, Chu and Schramm formulated general conclusions that were to influence most of the future investigation in educational television. The conclusions they reached defined the state of the art for educational television at that time.

> For one thing, it has become clear that there is no longer any reason to raise the question whether instructional television can serve as an efficient tool of learning. This is not to say that it always does. But the evidence is now overwhelming that it can, and, under favorable circumstances, does. This evidence now comes from many countries, from studies of all age levels from preschool to adults, and from a great variety of subject matter and learning objectives. The questions worth asking are no longer whether students learn from it, but rather, (1) does the situation call for it? and (2) how, in the given situation, can it be used effectively?

Throughout the 1960's, scholars continued to research the many variables involved in educational television production and their effects on the learner. Large quantities of descriptive data, dealing more with student-television interaction than with precise measurements of significance of the learning variable, began to appear. Moss (22) includes in his study a comment on what Bloom (2) would call the "affective" aspects of student-television interaction:

> The televised offerings must be carefully designed to penetrate the coldness of the picture tube and the passivity of the viewing audience.

The field of educational television has not been without its critics. Basing their conclusions on the great expectations of educational television and the negative results of the many comparative group studies, scholars began to seek an explanation for the inability of educational television to live up to its envisioned potential. Gilkey (12) and Siepmann (29) are among the most perceptive analysts of the problems facing instructional television. They criticize television as a teaching medium and label it misused and out worn, and they protest using television to perpetuate the lecture system and its "undynamic formats."

Modern researchers have defined precise advantages which serve as guidelines for the creation of televised curricular supplements. I. Kieth Tyler (33) and Wolfe (37) identify such advantages as use of television for magnification; transportation, i.e. bringing a teaching situation to the learner; association, i.e. employing special effects to bring two or more video images together for visual comparison; contrast, i.e. using visual images to stress importance; and recording rare incidents, i.e. this applies directly to the use of such video input as Skylab Television.

Gill (13) emphasizes the powerful nature of television for trying out new teaching techniques and demonstrating new concepts. This was also a prime consideration in the design of Skylab Television, as it will use astronauts and narration to convey the nature of visual activities and demonstrate the concepts thereof. Television, in Miller's (21) view, no longer has to apologize for its existance and try to convince educators of its value.

Up to now research has been the only means for evaluating television. Gordon (15) feels that research is an inadequate estimator of television's potential in the classroom. Gordon scrutinizes Miller's ideas on the nature of research and feels that this is a poor augury for the type of evaluation and validation that should be occuring with televised instructional materials. Miller's approach to research is the scholarly. His emphasis is on the worth of a study, its generalizability, competent analytical interpretation, replicability, and integrity. Gordon suggests, however, that much of television research is meaningless and ineffectual. He expresses the need for evaluating and validating classroom television on the basis of teacher and student opinions. Gordon states:

> One good and simple way to elicit such evaluations is to circulate questionnaires to teachers using ITV and ask them what they 'and the students' think of the lessons, and what suggestions for improvements they can make.

This investigator, while not able to generate statistics from his descriptive data which are acceptable to the modus operandi of the statistician, constructed an opinionnaire to formulate evaluations and validations along the lines Gordon suggests. Several of the key questions that Gordon asks include:

1. Did the lesson hold the students' attention?
2. Was the subject matter presented at the proper grade level?
3. Was the subject matter accurate, relevant, and well developed?
4. Did the lesson contain any materials, teaching tools, information, or talent not available to the conventional classroom?
5. Were graphic materials clearly visible on the T.V. screen?
6. What topics or points were of greatest interest to them, (the students)?
7. Did you notice any technical problems in the reception of either picture or sound?

N.B. items dealing with most of these areas appeared in the opinionnaire in this study.

The guidelines emphasized in the literature for preparation of television and its use to aid the curriculum point to trends which will involve researchers for perhaps the next decade. As the science curriculum makers of the 1960's were anxious to use the formalization of knowledge, content, and process available to them, so the science curriculum makers of the 70's will be anxious to use the media methodologies and new teaching strategies available to them.

A clear grasp of the limitations and nature of television comes from the studies attempted in the past. Guidelines for the future, while not geared toward comparison of methods but rather towards validation of video programs, will lead to a vast enrichment of present curricular offerings and interface with both the open-ended approaches to teaching science and the systems approaches by providing additional learning materials, learning experiences, and learning paths.

In this light, television programs from any source would serve to enhance the existing curriculum. Skylab television, itself intrinsically motivating, may make an outstanding contribution.

# CHAPTER III

# DESIGN AND METHODOLOGY

## Introduction

The operational procedure in this study was to show a group of students a television program relating to activities on the Skylab Space Station. The program was produced in two styles. First, a simulation of television as it will appear from Skylab when it is in orbit in 1973. Second, a conventional instructional television lecture produced in a studio with production visual aids. The students were then tested over the material, the tests being constructed from objectives formulated from the material content. The script was based on a presentation written for the Educational Programs Division of NASA over the topic of earth resources. This textual material was adapted by the investigator and synthesized into an operational television script.

In addition to the tests given to the students, an opinionnaire was formulated to gather descriptive data.

## The Sample

The sample used in this study consisted of students in four counties of north central Oklahoma, all four of which contain school districts in Region 5 of the Oklahoma Educational Television Operation. The headquarters of Region 5 is in Stillwater, Oklahoma. The study was administered during the Spring semester, 1972. The sampling was restricted to students enrolled in 10th grade biology. Over 2/3 of the group were using the Biological Science Curriculum Study (BSCS) green or yellow versions. This added some consistency to the preparational background of the students in the study.

This sample was dichotomized into classifications of urban and rural with the urban schools comprising those schools in the Tulsa School District and the rural classification indicating schools in suburbs or outlying towns in North Central Television Region 5. A minimum of 20 classrooms were needed to perform the study.

The urban sample was randomly selected by the Research Director of the Tulsa Public Schools, in cooperation with the Educational Support Center, from a population of all 10th grade biology classes in Tulsa Public Schools. This random assignment provided a cross section extending from middle class to inner-city schools. Six schools with two classrooms each participated in the study for a total of twelve urban classrooms in the sample.

North Central Region 5, an Oklahoma Educational Television Region, is composed of independent school districts. The rural schools were chosen from among these districts. The complete list of school districts was evaluated and all districts meeting the following criteria were invited to participate:

A) School districts who had high school facilities

B) School districts who had operational closed-circuit video equipment. N.B. many of the schools in the district did not meet this criteria due to various operational levels of their video equipment. The remaining schools were invited to participate in the study. Approximately 33% of the school districts responded to the letter and with one exception all were scheduled to participate. This provided an additional 9 classrooms one of which was not treated in the statistical analysis. The classroom group eliminated had been biased by an inadvertent viewing of a film on Skylab the day before the arrival of the researchers.

## Formulating the Television Programs

Implicit in the design of the study is the fact that two television programs juxtaposed for comparative purposes should contain identical content and emphasis. The only difference should be in the style of presentation.

The topic selected for use in this study was the earth resources experimental program on the Skylab Space Station. This topic was selected for two main reasons.

1. Earth resources is a relatively novel subject and a base level of nonfamiliarity could be assumed for all subjects in the study.
2. Earth resources has a good deal of bearing and relevance, and is comprehensible by a 10th grade biology student.

Areas of interface with the biological curriculum include scientific measurement, ecology, pollution, environment, and the ecosystem.

The script for both programs was synthesized from an earth resources presentation written for the NASA Educational Progams Division by the Space Science Education Project at Oklahoma State University. An introduction, which was to be identical for all students regardless of treatment, was written by the investigator. This was to provide a background knowledge and awareness of the Skylab Space Station, as students who will be watching Skylab Television will be aware of its existence and familiar with its basic purpose.

The Skylab Television simulation was the product of a one and one-half year study, by the investigator, of Skylab, its television facilities, and its television production capabilities. The investigator worked with the NASA Skylab Program Office which determined the operational Skylab Television system, the ground communication system, and the features of the television operation. The investigator worked also with teams from the Manned Spacecraft Center, Houston, Texas; Marshall Spaceflight Center, Huntsville, Alabama; and McDonnell-Douglas Corporation, Long Beach, California; participating in tests of the equipment and onboard production techniques. The investigator also worked with the Marshall Spaceflight Center personnel, the NASA Educational Programs Division, and the NASA Public Affairs Division personnel to establish the basic goals of educational television from Skylab and the nature and quality of the video information available from Skylab.

To simulate in flight activities onboard Skylab and views of the earth from space the investigator edited footage collected by the Audio-Visual Corporation for NASA's film library. The chemical nature of film reproduction when dubbed onto video tape provides a degenerated picture quality similar to the picture that will be transmitted by the television system to the classroom receiver. Some extra production techniques, e.g. superimposing unfamiliar words during the Skylab television program, were deemed necessary as these techniques would also be used in the studio version. These techniques are planned in actual Skylab Educational Television transmissions.

Likewise, it was necessary to conceive of the studio version as a high quality instructional television program and apply superior production and direction techniques so that both programs would represent a high degree of professional competency. The use of an identical script in the studio, ETV, version of the television program is insufficient to establish identity of emphasis and visual impact. To this end the investigator analyzed production techniques common to both television programs and attempted to employ them.

Several examples of production aspects common to both programs were identified: 1) The nature of transmission of television from space limits the time duration of video information, thus small video segments and ground based video input would be part of both the Skylab and the studio versions of the television program. 2) Identical film and slide materials were used, when available, in both programs. Their use was to emphasize or visually accent an important concept in the program. 3) The production of the studio version was accomplished using an independent director of national repute and a studio equipped with the finest video and audio facilities available today. The Skylab television was produced using the finest film libarary available and the audio sound tracks for both tapes were recorded on the same microphone at the same time.

The investigator provided the narration and the commentary for both programs and appeared in the studio version. Having the same person narrate both versions was an important factor for insuring identical word emphasis, audio quality, and homogenaity.

## Design of the Study

The study was conceived in two parts, the experimental evaluation of the two programs, and the descriptive opinionnaire. To accomplish the first objective a quasi-experimental counterbalanced design was selected. The television program was produced in two parts of equal length. This provided four separate video segments: Skylab Television Part 1, Skylab Television Part 2, Studio ETV Part 1, and Studio ETV Part 2. The four segments were then arranged on separate video tapes in such a way that a student seeing the first part of the program from Skylab would see the second part of the program in the studio version. Conversely, students seeing Part 1 in the studio version would see Part 2 in Skylab simulation.

It should be noted that this design is catagorized as a post test only design. This is predicated on the assumption that there was a base level of information or ignorance in the sample prior to the treatment. Functioning as a true counterbalanced design a post test was given after the students had seen the introduction and the first portion of the program. An additional post test was given after the students had seen the second portion of the program.

Campbell and Stanley (5) delineate some of the limitations of the post test only counterbalanced design. The design is particularly suited to the comparison of two forms of treatment, but is defined as a quasi-experimental design. It does not have a true cause-effect relationship, but is respected in behavioral statistics due to its high degree of versatility and applicability.

Two types of validity were established for the experimental portion of the study; face validity and content validity. Face validity was established through evaluation by two judges, both expert in science education and one expert in secondary biology curricula and 10th grade biology curriculum development. The second type of validity, content validity, was established by constructing specific objectives for the program and then delineating the precise program audio and visual content which exemplified and clarified the objectives. Tables I and II are the content validity tables used in the study. It should be noted that these objectives are the ones from which the instruments were derived.

Reliability for the instruments used in the study determined and influenced the construction of the instruments. Of course, high reliability is desirable. But in a counterbalanced single treatment design, a high reliability is imperative if the study is to be generalizable to a larger population.

After the administration of the experimental portion of the study and the exposure of the students to both types of television format, an opinionnaire was administered. Three major areas in which questions were to be asked were determined, and an approximately equal number of items were written for each of the three areas. Although the N for the experimental portion of the study was derived from the 20 classroom units, the nature of the opinionnaire allows an interpretation on a percentage basis of the total population of individuals within the class unit.

## Methodology

As previously mentioned, the method of administering the treatment

TABLE I

CONTENT VALIDITY: PART ONE

| Objectives | Content | Visuals | Related Test Items |
|---|---|---|---|
| 1. The student will be exposed to Skylab. | Introductory Segment | Animation of Skylab | 1,2,7,10 |
| 2. The student will learn how space can be used to study earth. | The synoptic view<br>Explanation of Skylab as a viewing platform. | Super: Synoptic<br>Views of Earth from space | 3,4,5,6<br>8,11,19,20 |
| 3. The student will learn usefulness of space photography. | Examples of space photography<br>Limitation of photographs | Saudi-Arabia Yemen photos | 9,12,13,14 |
| 4. The student will see scientists interpreting EREP information. | Evaluation of space geology | Views of geologic structures | 15,16,17,18 |

TABLE II

CONTENT VALIDITY: PART TWO

| Objectives | Content | Visuals | Related Test Items |
| --- | --- | --- | --- |
| 1. The student will see additional EREP Photography applications. | Colorado River Analysis<br>Forest Fires | Films and photos from space | 1,2,3,10<br>15,17 |
| 2. The student will learn about the Electro-Magnetic Spectrum. | Description of the Spectrum | Slide illustrating the spectrum | 4,5,6,7,9 |
| 3. The student will learn of non-visible remote-sensing techniques. | Multi-spectral, and other applications | Film of Multi-spectral and Infra-red photography<br>Super: Multi-spectral | 12,13,14,18 |
| 4. The studnet will understand limitations and advantages of EREP. | Explanation of Ground Truth and other limitations | Super: Ground Truth | 8,11,16,19 |

and collection of the data was an important concern. The data collection technique had to be designed to fit within a single classroom period. Scheduling needed to allow the investigator time to set up the video equipment and prepare the printed materials to be handed out.

To eliminate troublesome intervening variables, all of the classrooms were scheduled to allow the investigator a minimum of 12 minutes set up time. The television was placed on an elevated platform such that the screen was always at eye level with the investigator. Seats were rearranged within the classroom such that no student was farther than 20 feet or at an angle greater than 45 degrees from the perpendicular of the television screen. Seats were moved as close as possible to the television monitor, and all of the students were asked to sit in the nearest seat. In no classrooms were these guidelines violated. The room was darkened to its greatest extent, and in all but one classroom this included black shades drawn over the windows and the lights off. The investigator also angled the television monitor to reduce glare from the windows in every classroom, and a 180 degree survey of the television screen was performed in each classroom to insure a good view by all students.

The introduction of the investigator was identical in all classrooms. Students were told the name and the institution being represented. The investigator then proceeded to outline for the students what would happen during the treatment. The students were informed that they would watch a television show, be asked some questions, and then after responding to the questions would be given an opportunity for discussion.

Prepared question booklets were handed out to the students along with the prepared answer sheets. The students were instructed not to open the booklets, mark in them, or turn the pages until told to do so. They were familiarized with the answer sheets and shown how to mark them. They were also asked to check the appropriate box male or female and advised that they were not to put their names on the answer sheet and that their answers had no effect on their grade in the course.

At this point the lights were darkened and the students were told that they were going to see an introduction to the Skylab Space Station. Following the brief two minute introductory program, it was explained to them that they were to see a television program divided into two parts. One part was to be simulated as though Skylab were actually flying, and the other part was produced in a studio. The students were then shown the first portion of the program.

At the end of the first portion of the program the lights in the classroom were turned on, and the students were asked to answer the first twenty questions. This was Test 1. A maximum of ten minutes was allowed for the completion of Test 1; the mean group finished in a little over six minutes with the majority of the students finishing the test by the seven minute mark. If students were not finished, they were told to continue until done and almost 100% of the students finished within the ten minute limitation period.

At this time the lights were again turned off, and the second portion of the program, using the different format, was viewed. Following this the students were asked to complete the second twenty questions on the next two pages of the question book. Then an example was given concerning the use of the opinion scale. The statement that was used for the example was the same in every classroom. The students were then asked to express their opinions about each of the thirty statements in the opinionnaire. Enough time was given for all students to complete this task. In no classroom did this time exceed ten minutes. The average time of the individual treatment was forty-five minutes, well within the confines of the class periods used in the study.

For the remainder of the period students were given the opportunity to interact with the investigator on general topics relating to the subject matter of the treatment and the space program in general. When more than one classroom was to be examined in the same school, the investigator requested specifically that the students say nothing to other students about the program or the tests or the nature of the questions. In most schools the periods followed one another, and the brief period in between appeared to successfully nullify this problem. It should be noted that the video quality was adjusted to be virtually identical in every situation; however, the audio level was adjusted to meet the acoustical needs of the individual classrooms. A test pattern and test tone were present on each tape to permit this adjustment before the students entered. During the testing no talking was permitted, a five minute elapsed time signal was given, at the end of six minutes students were asked how many needed to finish, and then they were allowed to complete the test. In only one of the classrooms used in the study was there any major distraction in the form of outsiders entering the room, and this distraction was extremely brief.

The raw data was codified as to the classroom number and the treatment given. The treatments were assigned to classrooms on a random basis with an equal number of classrooms receiving Treatment 1 as receiving Treatment 2. Most of the classrooms exhibited three types of behavior in the early portion of the treatment. These types were: 1) slight hostility, 2) intent interest, 3) slight confusion. None of these behavioral traits, although detectable, were exhibited in extreme form. And the cooperation in all classrooms was extremely satisfactory.

## Instruments Used in the Study

There were two objective multiple choice tests and one opinionnaire used in the study. The multiple choice tests were designed directly from the content presented in the television program. A correct answer and three distractors were employed in all cases. Consultation revealed that a minimum of twenty items was essential for a test of reliability. The items were also checked for consistancy regardless of the format of the program viewed by the student, i.e. each question was evaluated using both the Skylab Television and the Studio versions to be sure that the material on which the question was based was equally clear in both programs. The reliability analysis was especially important since the investigator could not verify the test with a pilot group. The tests are reproduced in Appendix B.

The opinionnaire was employed in this study to obtain descriptive data useful in planning and restructuring Skylab Television formats for secondary science audiences. To this end opinion statements were written, and the student responded on a five point scale. Increments on the scale were; strongly agree (SA), agree (A), neutral (N), disagree (D), and strongly disagree (SD).

Some of the items used in the opinionnaire in the area of general attitudes towards science were taken from the Dutton Science Attitude Scale. The brevity of the treatment, however, precludes any statistical interpretation of even these items. The scale was developed by Wilbur H. Dutton and Lois Stephens (8). Although originally designed for elementary students the investigator decided that the items selected would be appropriate for high school science students, and that, due to the polarizing nature of some of the items, interesting results would thereby occur. The opinionnaire was reworked several times to assure brevity and simplicity.

The three major areas of items in the opinionnaire include; A) opinions on effectiveness of the program, B) opinions on the subject matter and its relevance, and C) opinions on science in general. The answer sheet described earlier was designed for maximum simplicity in use. This format, as opposed to a computer optical readout, was easier for the students to understand and required almost no orientation or explanation. In addition, boxes were grouped to provide easy readout for transcription onto computer punch cards.

## Statistical Procedures

The first hypothesis deals with differences between groups watching Skylab Television and the groups watching the studio version. The counterbalanced design provided that all groups tested had experienced both styles of television instruction. Therefore, the total group watching any one type of presentation involves the total population, and the N of each group is identical to the total N of the study. A pooled variance t-test was used to test this hypothesis. Application of this test is described by Popham (27). The t-test was performed between two groups. Scores of the classrooms watching Skylab Part 1 and scores of the classrooms watching Skylab as Part 2 formed one group, while scores of the classrooms watching the Studio Version Part 1 and scores of those watching Studio Version Part 2 formed the second group. $SETV_1 + SETV_2$ = Group 1, $ETV_1 + ETV_2$ = Group 2. The t-test was to determine if there was a significance difference between the means of the groups.

The computer program for this method includes an F-ratio of homogenaity. The F-test was applied to the variance of the two groups and the N's of both groups were equal. Significance at the .05 level was then evaluated.

A Kuder-Richardson Reliability Test was performed for each of the test instruments. Computer analysis was used to construct a right-wrong, item-respondent matrix.

Hypotheses two through four were correlated using a point biserial treatment to determine if any significant relationship existed between other variables considered in the study. These variables: male-female, urban-rural, Treatment 1-Treatment 2, were not considered appropriate for t-test evaluation. The standard point biserial statistical treatment was used.

The descriptive material dealt with in the research questions was organized by item and frequency of selection for each choice within that item. The items were then grouped into the three major categories, and the frequencies were converted to percents. This is the primary form for reporting the data in this study. The computer also weighted the choices of agreement from one to five, one indicating positive feeling or agreement, five indicating negative feeling or disagreement.

Negative responses were reversed for this scoring technique. And the mean scores of students were calculated. Over the thirty items a score of thirty would indicate complete agreement, a score of ninety complete neutrality, and a score of 150 complete disagreement. Notice that neutral scores tended to raise agreement scores and to lower disagreement scores.

The raw data was transcribed into punch card form and then manipulated using the Oklahoma State University IBM 360-65 Computer. The operations carried out by the computer were as follows: A) scored all of the test and opinionnaire items, B) established a matrix of right-wrong responses for the Kuder-Richardson Reliability Test, C) computed the means for each class group on each test and for all boys and all girls in each class group on each test, D) performed an item analysis of frequency of selection for each distractor in both test instruments, E) performed the t-test and correlation operations, F) printed mean scores for all tests, treatments, sexes, and locations, G) printed frequency of response for each item in the opinionnaire, H) arrived at mean scores for the three categories in the opinionnaire and group mean scores for the male-female, urban-rural, and treatment variables.

# CHAPTER IV

## RESULTS OF THE STUDY

The stated goal of the study is the evaluation of a novel television format for use as a supplemental curricular device. Its efficacy is tested by comparison with a standard Educational Television program format. In addition other significant variables have been identified and appropriate statistics applied to discover if any other relationships could be indicated. A qualitative instrument was also administered to indicate any trends or opinions as they exist in the minds of the student sample population. In this chapter the data is reported and evaluated with respect to the research hypotheses and research questions using the statistical procedures previously outlined. The classroom mean scores are tabulated in Tables III and IV.

Before reporting the findings as to the significance of differences and relationships, a preliminary statistic must be considered. Without reliability, the ability of the instruments to measure what we think they are measuring would be in grave doubt. It was therefore imperative to perform a test of reliability for each of the objective test instruments.

The Kuder-Richardson Reliability Test and its application in this study were described in the previous chapter. Bruning and Kintz (3) in their Computational Handbook of Statistics interpret the Kuder-Richardson Reliability Coefficient. Their guidelines recommend that

TABLE III

MEANS FOR CLASSROOM GROUPS:
TEST I

| Classroom | Total | Male | Female |
|---|---|---|---|
| 1 | 15.06 | 14.69 | 15.32 |
| 2 | 13.72 | 13.84 | 13.50 |
| 3 | 13.52 | 14.74 | 11.20 |
| 4 | 14.52 | 14.10 | 14.71 |
| 5 | 12.13 | 13.22 | 10.71 |
| 6 | 12.89 | 15.60 | 9.50 |
| 7 | 7.85 | 7.89 | 7.75 |
| 8 | 8.45 | 10.33 | 7.75 |
| 9 | 11.41 | 11.83 | 11.25 |
| 10 | 10.64 | 10.25 | 10.80 |
| 11 | 14.67 | 14.50 | 14.77 |
| 12 | 15.52 | 16.15 | 14.93 |
| 13 | 15.29 | 15.79 | 14.67 |
| 14 | 15.00 | 14.20 | 15.86 |
| 15 | 14.54 | 14.00 | 14.71 |
| 16 | 11.48 | 11.87 | 11.17 |
| 17 | 13.18 | 13.08 | 13.50 |
| 18 | 13.00 | 13.00 | 13.00 |
| 19 | 13.07 | 13.56 | 12.11 |
| 20 | 12.97 | 14.00 | 12.28 |

TABLE IV

MEANS FOR CLASSROOM GROUPS:
TEST II

| Classroom | Total | Male | Female |
|---|---|---|---|
| 1 | 13.66 | 13.23 | 13.95 |
| 2 | 12.41 | 12.58 | 12.10 |
| 3 | 11.90 | 12.32 | 11.10 |
| 4 | 13.52 | 12.90 | 13.81 |
| 5 | 10.44 | 11.33 | 9.29 |
| 6 | 12.22 | 13.60 | 10.50 |
| 7 | 8.27 | 8.61 | 7.50 |
| 8 | 7.82 | 8.00 | 7.75 |
| 9 | 10.27 | 11.00 | 10.00 |
| 10 | 9.71 | 9.38 | 9.85 |
| 11 | 12.48 | 13.38 | 11.92 |
| 12 | 15.15 | 15.54 | 14.79 |
| 13 | 14.62 | 14.95 | 14.20 |
| 14 | 13.17 | 13.67 | 12.64 |
| 15 | 13.79 | 12.71 | 14.14 |
| 16 | 11.06 | 11.27 | 10.89 |
| 17 | 12.41 | 12.38 | 12.50 |
| 18 | 12.15 | 12.64 | 11.00 |
| 19 | 10.70 | 10.94 | 10.22 |
| 20 | 12.70 | 13.75 | 12.00 |

an acceptable reliability be greater than 0.7. Increasing the length of the test will increase the reliability. It should be remembered, however, that a minimal number of test questions was desirable in this study to facilitate the administration within one class period. Despite this limitation the reliability coefficients were satisfactory for both test instruments. The coefficient of reliability for Test 1 was 0.738921. The coefficient of reliability for Test 2 was 0.709007. Both of these figures establish a base level of reliability for both test instruments.

## Testing the Hypotheses

The first hypothesis is stated as follows:

H 1: There is no significant difference in achievement between the SETV and ETV groups as measured by the differences in their scores on Test I and Test II (0.05 level of confidence).

The results shown in Table V indicate the acceptance of this hypothesis at the 0.05 level of confidence. The F value indicates significance or identity of variance. The variances being equal and the N being equal, the pooled variance t value 0.3269 is not significant at the 0.05 level for a two tailed test with 19 degrees of freedom.

Hypotheses two, three, and four were stated as follows:

H 2: There is no significant correlation between male and female students and their achievement on Test I and Test II.

H 3: There is no significant correlation between urban and rural location and their achievement on Test I and Test II.

H 4: There is no significant correlation between students receiving Treatment 1 and students receiving Treatment 2 based on achievement on Test I and Test II.

TABLE V

COMPARISON OF SETV VS ETV GROUPS

| Group | Mean Score | Variance | Standard Deviation | F Ratio | Degrees of Freedom | t Score |
|---|---|---|---|---|---|---|
| SETV | 12.697 | 13.74 | 3.71 | | | |
| ETV | 12.621 | 13.34 | 3.65 | 1.029 | 19 | 0.327 |

Table VI lists the cumulative means for both test instruments calculated for all of the variables considered in Hypotheses 2, 3, and 4. Table VII indicates the results of the point biserial correlation between the variables and their achievement levels. The values of the three coefficients of correlation and the t-test for significance indicate the acceptance of hypotheses 2, 3, and 4. No significant correlation was found between males and females, urban or rural location, or the experience of Treatment 1 or Treatment 2.

## The Research Questions

The first research question is stated as follows: Is there a general trend of favorable opinion formulated by the students as to the effectiveness of the television programs?

TABLE VI

MEAN SCORES FOR VARIABLE GROUPS

| Test | Female | Male | Urban | Rural | Treat 1 | Treat 2 |
|---|---|---|---|---|---|---|
| 1 | 12.92 | 13.43 | 12.83 | 13.61 | 12.79 | 13.55 |
| 2 | 11.93 | 12.38 | 11.77 | 12.63 | 11.69 | 12.61 |

TABLE VII

CORRELATION OF VARIABLES

| Hypotheses | Variable | Number | Mean | Correlation Coefficient | T-test |
|---|---|---|---|---|---|
| 2 | Male | 244 | 25.80 | | |
| | Female | 255 | 24.85 | -0.07 | 1.59 |
| 3 | Urban | 281 | 24.60 | | |
| | Rural | 218 | 26.24 | 0.12 | 2.73 |
| 4 | Treat 1 | 250 | 24.48 | | |
| | Treat 2 | 249 | 26.16 | 0.12 | 2.81 |

Statements in this section of the opinionnaire ranged over topics dealing with the nature of the students opinions on television and on various aspects of the student's interaction with the Skylab and Studio television programs. The statements reflected opinions on the students' own concepts about the nature of the programs. Table VIII illustrates the percentage of students responding to each choice for all of the items in category A. Statements asking for negative opinion or stated in negative form were reversed. A combination of percents for strong agreement and agreement indicates a positive opinion on the item. Averaging all the positive opinions in group A gives a mean value of 66.8%. This indicates that over 2/3 of the students expressed positive opinion with respect to item A. While not a statistic with sufficient rigor to warrant a confidence statement, the trend of positive opinion is numerically two to one over these topics.

Included in the statements in this category were items allowing the students to react to the presentation in the program, the concepts in the program, the clarity of the program, and the major conceptual basis included in the program, e.g. the student's concept of his own grasp of the major topics and ideas in the program, such as earth resources and the usefullness of space.

Research question 2 is stated as follows:

Is there a general positive opinion formulated by the students as to the relevance and subject matter of the programs?

Applying an identical mathematical treatment the positive expression of opinions in category B (Table IX) dealing with the relevance and subject matter of the programs, was calculated in percentages. The cumulative positive percentage for all items in category B was 71.2%, indicating a high general positive opinion by the students as to

TABLE VIII

PERCENTAGE VALUES FOR OPINIONNAIRE ITEMS:
CATEGORY A*

| Item | Choice 1 | Choice 2 | Choice 3 | Choice 4 | Choice 5 |
|---|---|---|---|---|---|
| 4 | 23.6 | 35.9 | 16.6 | 21.2 | 2.6 |
| 5 | 10.6 | 54.5 | 15.2 | 15.6 | 4.0 |
| 6 | 45.5 | 34.9 | 9.4 | 5.8 | 4.4 |
| 7 | 6.6 | 13.4 | 24.4 | 40.1 | 15.4 |
| 10 | 15.6 | 50.7 | 14.2 | 14.4 | 5.0 |
| 11 | 6.6 | 49.2 | 21.4 | 17.2 | 5.4 |
| 16 | 18.0 | 51.3 | 17.4 | 10.8 | 2.4 |
| 18 | 37.0 | 46.9 | 9.4 | 4.0 | 2.6 |
| 21 | 13.2 | 43.5 | 31.9 | 10.6 | 0.8 |
| 27 | 14.0 | 61.9 | 18.6 | 3.2 | 2.2 |

* Total Average Positive Percentage (Choice 1 + Choice 2): 66.8

TABLE IX

PERCENTAGE VALUES FOR OPINIONNAIRE ITEMS:
CATEGORY B*

| Item | Choice 1 | Choice 2 | Choice 3 | Choice 4 | Choice 5 |
|---|---|---|---|---|---|
| 2 | 26.9 | 50.3 | 17.0 | 5.2 | 0.6 |
| 12 | 65.5 | 24.6 | 7.6 | 1.0 | 1.2 |
| 13 | 18.6 | 42.5 | 22.8 | 10.4 | 5.6 |
| 14 | 19.4 | 47.5 | 21.0 | 7.2 | 4.8 |
| 15 | 24.4 | 41.1 | 22.6 | 8.8 | 6.0 |
| 17 | 30.4 | 35.5 | 24.8 | 5.8 | 3.4 |
| 19 | 15.2 | 47.3 | 27.6 | 7.8 | 2.0 |
| 22 | 14.0 | 57.9 | 22.4 | 4.2 | 1.4 |
| 29 | 18.2 | 43.0 | 26.0 | 8.8 | 3.8 |
| 30 | 42.9 | 47.1 | 7.8 | 1.4 | 0.8 |

* Total Average Positive Percentage (Choice 1 + Choice 2): 71.2

the relevance and subject matter of the program. Particular items in this category related to uses and application of earth resources, appreciation for earth resources, and the student's desire to have additional Skylab Television programs. 71.2% balanced against neutral and negative responses indicates a very high percentage of positive opinion with regard to this question. This is perhaps the strongest numerical indication of opinion in the study.

Research question 3 is stated as follows:

Is there a general positive opinion expressed by the students concerning general attitudes towards science?

The numerical value of average percentage for positive responses in category C was 58.3%, (Table X). This category, relating to the third research question deals primarily with items taken from the Dutton scale. In this study the context for general opinions on science was to provide a background for creating a general approach to Skylab Television programming. While 58.3% indicates a high degree of positive opinion, it is not as strong as the general opinions on the effectiveness of the program and the relevance and subject matter in the program. With these constraints one could only indicate a slight tendency towards positive opinion rather than a general indication of it.

In a scale of the type used in the opinionnaire, the middle choice is for a neutral stand. Students were also told to apply this choice if they were not sure what was asked for in the question. Taking an average percentage of students selecting this option, and using a mean figure, expressing the percentage of students likely to use this option in any given item on the opinionniare, it was found that 20.5%

TABLE X

PERCENTAGE VALUES FOR OPINIONNAIRE ITEMS:
CATEGORY C*

| Item | Choice 1 | Choice 2 | Choice 3 | Choice 4 | Choice 5 |
|---|---|---|---|---|---|
| 1 | 33.7 | 53.5 | 7.0 | 5.4 | 0.4 |
| 3 | 13.4 | 18.0 | 26.9 | 30.9 | 10.8 |
| 8 | 8.2 | 27.5 | 30.6 | 24.8 | 8.8 |
| 9 | 12.6 | 31.3 | 38.5 | 13.2 | 4.4 |
| 20 | 21.8 | 39.5 | 20.8 | 11.2 | 6.6 |
| 23 | 30.5 | 37.3 | 18.0 | 9.2 | 5.0 |
| 24 | 15.4 | 35.5 | 25.9 | 13.8 | 9.2 |
| 25 | 18.0 | 37.7 | 28.3 | 11.2 | 4.8 |
| 26 | 27.7 | 50.3 | 15.0 | 5.2 | 1.8 |
| 28 | 5.6 | 9.4 | 24.4 | 32.0 | 28.5 |

* Total Average Positive Percentage (Choice 1 + Choice 2): 58.3

of the students might have chosen this choice for any given statement. Allowing an additional 1/5 of the students to have no opinion makes the numerical values for percentages of factors A, B, and C all the more meaningful. Figures of 66.8%, 71.2%, and 58.3% of the total population indicate general positive opinion with an additional 20% added to each of these figures this would leave only small percentages of general negative opinion. The ramifications of this with regard to drawing conclusions from the descriptive data will be discussed later.

## Additional Findings

Several other points with regard to the methodology of the study should be emphasized at this time.

1. The design of the study indicated that data could be successfully collected without excessively impinging on the classroom or teacher time.
2. Although in terms of logistics and data processing the study was relatively large, it would be possible in the future to streamline these processes and design a very efficient data gathering and processing operation.
3. Discussions following the administration of treatments revealed an intense interest on the part of the students in the space program, in future space investigation, and in other topics related to the aerospace field.
4. Oral interaction with the students following the treatment revealed an interest in experiencing additional programs of the type demonstrated in Skylab Television.

# CHAPTER V

## SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

### Summary

The study was carried out by formulating a model of what Skylab Television would look like, writing a sample script, and producing it in both Skylab simulation and standard studio educational television versions. These scripts were then produced and edited on video tape.

The television program was divided in half and arranged in a counterbalanced design. Two objective test instruments were developed, one covering the first half of the program the other the second half. The opinionnaire was then constructed consisting of 30 items dealing with the effectiveness of the program, relevance of the programs, and general opinions on science.

Twenty classrooms were then scheduled and each classroom experienced one of the two treatments. The treatments being divided as to which type of television was seen first, the Skylab or the studio version. It was hoped that the study would provide some information as to the effectiveness of the new format of Skylab Television as a teaching device and that some guidelines would be provided for the formulation of other television programs from Skylab in other subject areas and on other topics.

## Conclusions

No significant difference was observed in the achievement of the SETV and the ETV groups at the 0.05 level of confidence. In addition no significant correlation was observed between three groups of organismic variables; male-female, urban-rural, and Treatment 1-Treatment 2.

Two approaches may be taken for the evaluation of this data. Seemingly little difference existed between the major groups considered for analysis in the study; however, there is a great deal of basic knowledge as to the effectiveness of television in the classroom. Therefore, we can compare our results not in terms of the inability of the technique to produce a significant difference from another technique, but rather in terms of the technique being as valid and significant as the other technique in a classroom setting.

This implies that the Skylab Television Educational Programs would have at least as much impact as a normal educational television program in the classroom situation. In addition, the Skylab Television works equally well regardless of location, format, or sex.

The opinionnaire portion of the study revealed a high degree of positive opinion with regard to the nature of the television programs and the concepts expressed in the television programs. Fully 2/3 of the students responding indicated that they enjoyed the program, felt that it was logical, and that they had a good grasp of the ideas that the program presented. Over 70% of the students expressed positive opinions as to the nature of earch resources, its potential benefits for mankind, and other topics within the program. Slightly less than 60% of the students had a positive or favorable opinion on science in school and as a part of our society.

These general conclusions are extremely important. Two general trends of thought exist in our society: A) That people mistrust and are turning away from science intellectually and B) That people have a blind faith and reverence for science and its ability to achieve its established goals. The generally positive responses to items concerning science reinforce the scientistic concept, i.e. blind acceptance, of science as the great problem solver.

Item 8 provides an interesting insight into the criticism that students blindly accept science as a cure all. It reads: Science will eventually solve our major problems. Thirty percent of the students remained neutral on this question, 35% agreed, and 33% disagreed. Apparently the students had extremely mixed feelings on this subject and it indicates that they may have a perspective on the process of science. Forty-three point nine percent of the students did feel that science was relevent to their experience, however (Item 9).

The students also expressed favorable opinion with regard to learning more about science and its importance as a subject to be learned in school, as can be seen in Item 23: Science is not as important as other subjects. The students expressed a positive opinion by negative responses. Sixty-seven point eight percent of them indicated that science is as important as other subjects. With 18% of the students remaining neutral only 14% of the students felt that science was not as important as other subjects. This two to one agreement ratio, with almost 1/5 neutrality, indicates a broad recognition in the minds of students of the importance of science in the curriculum.

Another conclusion to be drawn from this data deals with the students opinions on television and television learning. Item 6: I don't learn from television, was contested by over 80% of the students who apparently felt that they did learn from television. In addition, approximately 2/3 of the students (66.3%) felt that they could see clearly what was happening in the Skylab Television pictures.

With regard to the relevance and content of the program, Item 12: We must do something about our ecology crisis, and Item 2: Earth resources may help solve some world problems, have 90.1% and 77.2% agreement respectively. The students also recongized one of the key points in the content of the program, i.e. Item 22: Earth resources has some limitations. Seventy-one point nine percent of the students agreed that on the basis of the data given to them in the program this was so, and the majority of the scientific community concurs with this opinion.

Other items of specific interpretational significance should also be discussed. In particular, Item 15 states: I would like to see more television from Skylab. Sixty-five point five percent of the students, with over 1/5 neutrality, expressed the desire to see more television from Skylab. Only 15% of the students did not wish to see additional Skylab Television. This opinion should spur further planning of real time Skylab Television input for the schools, as the opinion favorability ratio was two to one.

Following the guidelines of Gordon, the high positive opinions with regard to this novel television programming will apparently have a positive effect on students in their curriculum. If in addition the programs are well constructed, carefully founded on educational objectives, and carefully integrated into the curriculum, a positive force for educational development will have emerged from Skylab Television. The plethora of no significant difference studies preceding this research effort do indeed reinforce the importance of becoming certain that a new device is at the very least as effective and if possible elicits positive responses from the students as a teaching device. This researcher therefore concludes that Skylab Television when produced from space will fulfill these requirements and, if properly used, will enhance the process of education in the United States.

## Recommendations

Several recommendations emerge from this study for the development of further television programs from space and other curricular devices.

1. Skylab Television treatments to have any real impact should consist of a series of programs over similar subject areas rather than a single program or a single experience for the students. Behavior exhibited by the students in the classroom indicated an initial unfamiliarity and uncomfortable disposition with the program, primarily due to a lack of pretreatment introduction. A series of programs with proper introduction and classroom teacher follow-up would be a more meaningful experience for the students, N.B. that despite the initial uncomfortability there were high positive opinions expressed by the students as to the program and its content.

2. Studies of this type over a longer period of time with longer test instruments would provide not only increased reliability but also the opportunity to measure actual attitudinal changes on the part of the students participating. The brief nature of this study permitted only a descriptive opinionnaire to be administered and precluded more precise statistical interpretation of the results.
3. Further experimentation should be attempted with regard to the nature of administration of treatments for A) brevity and B) facility. Data gathered in this way can be useful particularly if a situation is developed where a particular group of students would have an open and varied enough experience to readily accept curricular experimentation. It should be pointed out that information gathered in this way by such a group of students would not be generalizable to the total student population, but could provide extremely valuable pilot studies for establishing variables and validating instruments for larger population studies.
4. Constraints of time placed on the investigator precluded efforts to gather a larger rural population than those from whom positive voluntary responses to participate were received. While the urban portion of the study was more controllable in terms of the generation of a random cross section, and was therefore generalizable to the entire urban population of that city, the rural study was generalizable only to the group of students actually participating therein. Any replication of this type of investigation should include

a broader base of independent school districts to allow generalizing to a much larger population. While this may have little bearing on the results, it has distinct bearing on generalizing these results to populations other than those tested.

5. Replications in a study of this type should be performed in several urban areas and several rural areas to provide larger population generalizability.

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APPENDIX A

TELEVISION SCRIPT

Introduction

In May, 1973, the United States will launch a Space Laboratory called Skylab. The next day a group of three Astronauts will be launched in an Apollo Capsule - Rendez-Vous with Skylab and live there for up to 28 days. That is twice as long a time as men were in space on flights on Gemini and Apollo. Then, they will get back into their Apollo capsule and return to Earth. A second and third group of Astronauts will follow. Both of the two following groups will stay for up to 56 days.

Skylab uses a great deal of hardware left over from project Apollo. The Space Lab is made inside the third stage of a Saturn V-Moon Rocket. The three groups of three Astronauts will be ferried to Skylab using smaller Saturn-1-B Rockets left over from the successful Apollo Test Program.

Skylab is a stepping stone to long range orbital space stations, and future space exploration. The three major goals of the Skylab Program are:

1. To study the effects of long space flights on men and space craft.
2. To carry on the most extensive space research program we've ever had in Astronomy and Space Physics.
3. To study processes in Space for making things needed on Earth, and studying the Earth itself from Space. This project is called Earth Resources.

When Skylab is in Space it is a cluster of several sections:
The third stage of the Saturn v is the orbiting work shop with storage, cabin for the crew, and experiments. Then there is an airlock for entering and leaving. A solar observatory called the Apollo Telescope Mount, A Docking Adaptor which has some experiment control panels, and the Apollo Capsule-with its service module to take the crew home.

Part I

A new view of Earth is required to cope with the problems posed by a deteriorating environment, vanishing natural resources, advancing technology, and expanding population. This view must be more comprehensive than any man has had before. Moreover, Earth must be seen as a whole. The problems of the air-ocean-land system that support life are world-wide. It is in getting global information that Skylab excells. This is part of the Earth Resources Program.

Skylab provides views of the Earth synoptically--that is to say--all at once. Large scale features of a huge area are revealed in a single picture taken under uniform lighting conditions. Much detail and contrast might be lost in a group of pictures made from airplane surveys.

After launch, Skylab can gather information as it swings around Earth. The steady flow of data can help to keep maps and charts current. This information can alert government, science and industry to conditions making it possible to exploit any opportunities or avoid disasters. Moreover, Skylab can acquire information from areas where other means would be expensive or hazardous.

Skylab, with its sophisticated sensing equipment and the observational capability of the crew, offers an Earth observation capability never before achieved.

During our eight month mission period, Skylab will fly over the United States, much of Europe, all of Africa, Australia, China, almost all of South America, and the oceans between. In traversing this area, about 75 percent of the Earth's surface, Skylab can pass over a given point every five days so that changes on Earth can be studied periodically. Here are the three major advantages of the synoptic view:

1. Skylab sees the Earth and its problems all at once.
2. Skylab sees all this on a regular basis.
3. Skylab gives us a super bird's eye view and detail.

Aircraft and spacecraft that gather information about the Earth use a technique called remote sensing. Remote sensing is acquiring knowledge about an object from a distance.

This photograph made with a film camera is of the (Saudi Arabia and Yemen) area. It covers almost 100 miles from side to side and 100 miles from top to bottom. This produces a very excellent and beautiful view of almost 10,000 square miles. To cover this much area with conventional aerial photography would require hundreds of photographs and several days of aircraft time. In addition, the joining of the small pictures together, a process known as "dodging," creates areas where the photography cannot clearly be interpreted. Probably one of the greatest advantages of space photography over aerial photography is that the sunlight condition is constant over the entire 10,000 square miles. This would be impossible with aircraft photography.

If we show a picture of this region to a trained geologist, he can analyze the complex geology and wide variety of physical features over this large area. The most striking feature of this photograph is the well developed pattern of fracture lines in the rocks. Although no other pattern is apparent, computer analysis indicates the pressence of dome structures. These domal structures are irregularities in the earth's structure that could indicate the location of oil and natural gas. So the view from space becomes not only a beautiful sight but one of potential economic benefit.

Part II

This is a view of (the mouth of the Colorado River). Although it is not exact enough for navigation, the resulting chartlet shows a potential application for small-scale color photography. This type of photography could warn of ice floes, help with oceanographic survey planning, obtain information about inaccessible areas, help us interpret geologic structures, supplement other data in ocean current studies, and aid in updating small-scale charts.

From one hundred and fifty miles up, the plumes of forest fires appear quite clearly. Wood, which takes years to replace, can be protected from fire and disease with remote sensing instruments.

So far, we have shown you only optical photographs taken with conventional cameras from space. This is, for sure, remote sensing. However, on Skylab we have new and exciting instruments to supplement and augment conventional photography.

In remote sensing, we look at the electromagnetic energy spectrum. The wavelengths decrease from very long radio waves to very short gamma rays. The very long waves carry radio and television signals while radar, microwaves, and the infrared regions all have different properties. The very small colored region represents that part of the energy spectrum that is visible. It is really a small portion of the total energy present. Finally beyond visible light is the ultraviolet region, X-rays, and gamma rays, again wave-lengths with unique properties. And because of these unique properties, sensors such as radar, spectrometers, radiometers, and X-ray machines, have been developed; all of them consistent with our definition of remote which means "at a distance." Of course, the distance that NASA is interested in using is quite a large one, over 200 miles in Skylab. This gives us the benefits of high altitude with benefits of the various sensors man has developed for use of all the kinds of electromagnetic energy he can measure.

Time sequence photography, is an important procedure in the development of remote sensing. Just as important is the need for "ground truth," or having someone in the field to verify the remote sensing data when it is gathered. Another point that should be made is that on Skylab we use multispectral cameras. Multispectral simply means we use several cameras at the same time, and take pictures in several colors, of the same thing. On Skylab we take pictures of blue-green-red and infra-red energy.

These bands have been selected to give us the most information about things like vegetation recognition and identification of crops and moisture. NASA's approach to remote sensing of the Earth's resources is not the complete answer. However, with the sensors we have shown you on Skylab cameras, spectrometers, the information processing techniques, multispectral photography, and computers, we can record usage of resources almost as soon as they occur. We can project man's impact on his environment. It will be possible to immediately analyze the seriousness of natural catastrophes. Technology such as this may very well be the key to answering the question.

# APPENDIX B

## TEST I, TEST II, OPINIONNAIRE,

## AND ANSWER SHEET

1. Skylab is best described as:

   A. A moon ship
   B. A tiny satellite
   C. An orbiting laboratory
   D. An airplane

2. Skylab contains all of the following except:

   A. 3 astronauts
   B. Scientific equipment
   C. Cameras
   D. Live plants

3. One of earth's problems Skylab hopes to help solve is:
   A. To help man learn about his future
   B. To help man learn about his planet
   C. To help man learn about his past
   D. To help man learn about his moon

4. The Earth Resources Program (EREP)
   A. Studies the land-sea-and air on earth
   B. Studies human skills
   C. Studies photography techniques
   D. Studies space orbits

5. The main advantage of using Skylab in earth resources is:
   A. Skylab lets us look at the whole system
   B. Skylab lets us see the dark side of the moon
   C. Skylab flies lower than airplanes
   D. Skylab is an ecosystem

6. The word that describes Skylab's view of the earth is:
   A. Synchronous
   B. Synoptic
   C. Assymptotic
   D. Capillar

7. This view helps us see earth
   A. In relation to the moon
   B. Every other day
   C. Sympathetically
   D. All at once

8. All of the following describe Skylab's synoptic view except:
   A. You cover a lot of the earth's surface
   B. You are closer than an airplane
   C. You get to see places on earth very often
   D. You get a good bird's eye view

9. One advantage a space photograph has over an airplane photograph is
   A. It is closer to earth
   B. It shows more details
   C. It has uniform light over a large area
   D. It doesn't need flashbulbs

10. From Skylab we can see about ___% of the earth's surface.
   A. 10%
   B. 50%
   C. 75%
   D. 100%

11. Remote sensing is best defined as:
   A. Sensing at a distance
   B. Sensing with a motor
   C. Measuring electrically
   D. Measuring by remote control

12. A photograph from Skylab can cover about
   A. 1 mile by 1 mile
   B. 10 miles by 10 miles
   C. 100 miles by 100 miles
   D. 1,000 miles by 1,000 miles

13. A photograph from space has all these advantages <u>except</u>:
   A. It needs no dodging due to even light
   B. It has uneven light
   C. It covers a large area
   D. It is less expensive in the long run

14. One of the sciences that can make direct use of a space photograph is:
   A. Chemistry
   B. Astronomy
   C. Zoology
   D. Geology

15. Features on a space photograph may help a scientist locate
   A. The center of the earth
   B. Oil and natural gas
   C. Future mountain formations
   D. Animal migration

16. An example of a remote sensor is:
   A. A thermometer in water
   B. A finger touching a stove
   C. A camera in a space craft
   D. A meter in an electric circuit

17. Earth Resources experiments
    A. Are the only ones on Skylab
    B. Are most of the experiments
    C. Are included with Biology and Physics experiments
    D. Are a small part of Skylab experiments

18. Monitoring our environment from space
    A. Answers all our problems
    B. Will affect our environment
    C. Gives us useful information
    D. Affects our weather

19. Major threats to our environment include all of the following <u>except</u>:

    A. Vanishing natural resources
    B. Expanding population
    C. Deteriorating environment
    D. Shortage of computers

20. Skylab is better for earch resources than an unmanned satellite because:
    A. It can carry better cameras
    B. It can fly over more area of the earth
    C. Men can evaluate data better than machines
    D. Satellites tend to wobble in orbit

1. Space photography may help in all these areas except:
   A. Ocean surveys
   B. Exact maps for navigation
   C. Geologic surveys
   D. Ocean current mapping

2. Skylab tells us much about our oceans, especially about:
   A. Life at the bottom of the sea
   B. Information about submarines
   C. Location of floating ice
   D. Height of waves

3. Skylab can help us with our wood resource in all of the following ways except:
   A. It can spot forest fires
   B. It can count trees
   C. It can detect deseased forests
   D. It can survey large forest areas

4. Remote sensing equipment on Skylab detects ____________ energy.
   A. Electromagnetic
   B. Potential
   C. Electric
   D. Gravitational

5. Which of the following is not on the electromagnetic spectrum:
   A. Radio waves
   B. Visible light
   C. Sound waves
   D. X-rays

6. Which of the following best describes the amount of the electromagnetic spectrum that is visible to our eyes:
   A. Almost all the spectrum is visible light
   B. Most of the spectrum is visible light
   C. Only about half
   D. Very little

7. Remote sensing is best defined as:
   A. Sensing at a distance
   B. Sensing with a meter
   C. Measuring electrically
   D. Measuring by remote control

8. Skylab orbits about ____ miles above the earth.
   A. 20
   B. 100
   C. 200
   D. 10,000

9. We use the different wave lengths of electromagnetic waves in earth resources because:
   A. We can't count on good weather
   B. We must avoid cosmic rays
   C. Different wave lengths are longer
   D. Different information helps identify different things

10. We use time sequence photography
   A. To tell time
   B. To measure changes periodically
   C. To sequence photographs
   D. To measure orbit changes

11. Ground truth is necessary
   A. To be sure what we see in a photograph is what is there
   B. To be sure we are as high as we think we are
   C. To show the actual position of Skylab
   D. To measure orbit changes

12. Multispectral means all <u>except</u>:
   A. We have ground truth with a camera
   B. We use several cameras at the same time
   C. We use many different color filters
   D. We have more information about an area

13. Multispectral photography is most useful
   A. For making maps
   B. For studying vegetation and crops
   C. For studying clouds
   D. For finding ice flows

14. All of the following techniques are used on Skylab for earch resources <u>except</u>:
   A. Cameras
   B. Multi-spectrometers
   C. Microscopes
   D. Computers

15. An immediate way to use earth resources is to
   A. Evaluate hurricane damage
   B. Study moon samples
   C. Evaluate medical data
   D. Study photography techniques

16. All of the following describe the earth resources program <u>except</u>:
   A. It is a fairly new thing
   B. It offers help for man
   C. We are still not <u>sure</u> how effective it is
   D. It could all be done on earth in less time

17. Forest fires seen from space look like:
    A. Bright balls of light
    B. Streaks of smoke
    C. Black areas
    D. Blue circles

18. Which of the following is most nearly correct:
    A. Skylab measure many kinds of electromagnetic energy
    B. Skylab measures only one kind of electromagnetic energy
    C. Skylab measures no electromagnetic energy
    D. Skylab measures only nuclear energy

19. The one thing in this list that you can't see from space is:
    A. Forest fires
    B. Men
    C. Rivers
    D. Mountains

20. Skylab has ____ astronauts on board.
    A. One
    B. Two
    C. Three
    D. Four

1. Scientists invent things to improve everyday living.
2. Earth Resources may help solve some world problem.
3. Science seems over my head.
4. Skylab looks very complicated.
5. Details on Skylab were fairly clear.
6. I don't learn from television.
7. Earth Resources is not a cure-all for earth's ecological problems.
8. Science will eventually solve our major problems.
9. Science is not relevant to my experience.
10. I couldn't make out what was going on in the pictures from space.
11. I feel I understand basically what earth resources is all about.
12. We must do something about our ecology crisis.
13. Watching the astronauts work with the equipment was interesting.
14. I was interested in the TV program.
15. I would like to see more television from Skylab.
16. The concepts in the TV program were well explained.
17. I would rather see Skylab TV than a studio-made version.
18. We can learn a lot about earth from space.
19. I would like to find out more about earth resources.
20. I like to do science experiments.
21. Skylab is very large.
22. Earth resources has some limitations.
23. Science is not as important as other subjects.
24. Science in school is interesting.
25. I am interested in learning more about science.
26. Science is an important part of society.
27. The presentation of ideas in the program was logical.
28. Science is boring.
29. I would like to find out more about Skylab.
30. Earth resources deals with a lot of things in our lives.

**TEST 1**

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**TEST 2**

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**OPINIONNAIRE**

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Male ☐ Female ☐

APPENDIX C

COVER LETTER

**OKLAHOMA STATE UNIVERSITY • STILLWATER**

Research Foundation
(405) 372-6211, Ext. 271

74074

Dear Sir:

In May, 1973 NASA will launch America's first orbiting space laboratory -- SKYLAB. NASA has placed great effort in planning educational television for use in the schools during the SKYLAB missions.

Your school system is invited to participate in a research study that will help Oklahoma State University provide NASA with the applicability and format information that will be the most useful for the schools.

The study is designed to require a minimum of time from your school operations. The population to be studied are only tenth-grade biology classes in the high school and the collection of data will take only one class period, during one school day. If you have more than one section of biology, and want them to participate, that can be arranged in their class period as well.

NASA is in need of this data and it is hoped that the data can be gathered by OSU before the close of this school year. One day during the week May 8-May 12 will be all that is required. The teacher is required to prepare nothing and say nothing prior to the arrival of the OSU Space Science Education Project researchers.

Would you please notify the teachers and provide their names, the school addresses, and the date you have selected.

Thank you for your cooperation,

Kerry M. Joels
Space Science Education Project
OSU Graduate Student

Kenneth E. Wiggins
Associate Director
Research Foundation and
Director, Space Science
Education Project, NASA

APPENDIX D

PARTICIPATING SCHOOL DISTRICTS

TULSA COUNTY

Jenks Public Schools
Jenks, OK 74037

Sand Springs Public Schools
Sand Springs, OK 74063

Tulsa Public Schools
Tulsa, OK

CREEK COUNTY

Mannford Public Schools
Mannford, OK 74044

LINCOLN COUNTY

Stroud Public Schools
Stroud, OK 74079

Wellston Public Schools
Wellston, OK 74881

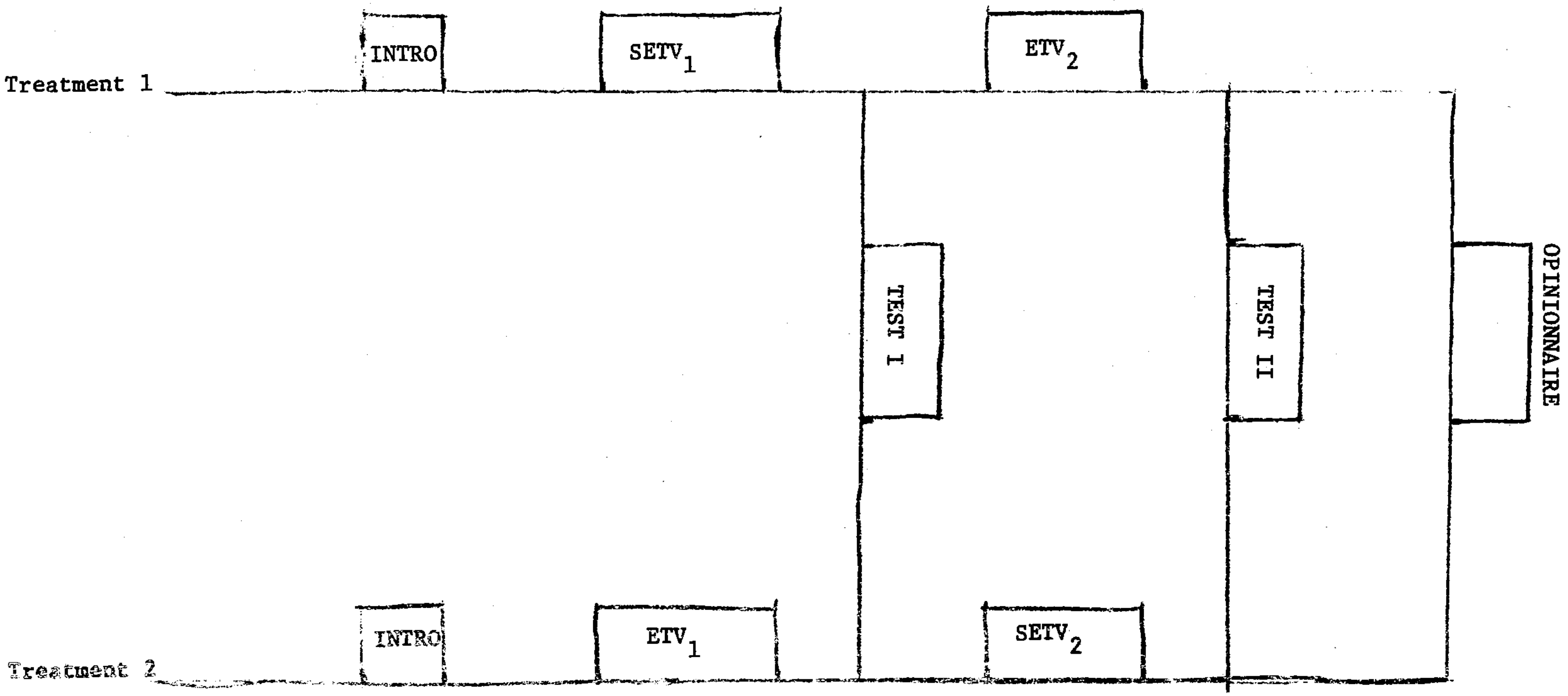
PAYNE COUNTY

Cushing Public Schools
Cushing, OK 74023

Glencoe Public Schools
Glencoe, OK 74032

APPENDIX E

DESIGN FLOW CHART


Treatment 1
INTRO
SETV1
ETV2
TEST I
TEST II
OPINIONNAIRE
Treatment 2
INTRO
ETV1
SETV2

APPENDIX F

MEAN SCORE VALUES FOR THE OPINIONNAIRE

TABLE XI

MEAN SCORE VALUES FOR THE OPINIONNAIRE

| Variable | Category A | Category B | Category C | Total |
|---|---|---|---|---|
| Male | 21.66 | 22.17 | 25.86 | 69.70 |
| Female | 22.71 | 24.31 | 26.22 | 73.24 |
| Urban | 22.84 | 24.43 | 26.54 | 73.81 |
| Rural | 21.38 | 21.76 | 25.40 | 68.53 |
| Treat 1 | 22.56 | 23.48 | 26.28 | 72.33 |
| Treat 2 | 21.83 | 23.04 | 25.80 | 70.68 |

N.B. Mean Scores: Ideal Case. . .(Total Means). . . SA = 30, A = 60

N = 90, D = 120, SD = 150.

VITA

Kerry Mark Joëls

Candidate for the Degree of

Doctor of Education

Thesis: EFFECTIVENESS PARAMETERS FOR THE USE OF EDUCATIONAL TELEVISION FROM SPACE AS A SUPPLEMENTAL CURRICULAR DEVICE

Major Field: Higher Education

Biographical

Personal Data: Born in New York City, New York, March 7, 1946, the son of Merrill E. and Marion C. Joëls.

Education: Graduated from Stuyvesant High School, New York City, New York, with Merit, in 1963; received a Bachelor of Science degree from Principia College, Elsah, Illinois, in 1967, with majors in Physics and Education; received a Master of Arts degree from the University of Illinois, Urbana, Illinois, with major in History of Science, in 1968; completed requirements for the Doctor of Education degree at Oklahoma State University, in July, 1972.

Professional Experience: Head Laboratory Assistant: Geology and Physical Science, Principia College, Elsah, Illinois, 1966-1967; Graduate Research Assistant, University of Illinois, 1967-1968; Instructor of Physical Sciences, Principia College, 1968-1969; Instructor of Physical Sciences and Education, Principia College, 1969-1970; Graudate Research Assistant, Space Science Education Project, Oklahoma State University, Stillwater, Oklahoma, 1970 through 1972.

Professional Memberships: Member; Institute of Human Ecology, Fellow; Royal Astronomical Society, London, England.