AN APPLICATION OF SYSTEMS ANALYSIS TECHNIQUES IN THE DEVELOPMENT OF INSTRUCTIONAL TELEVISION UNITS FOR INSERVICE ELEMENTARY TEACHERS

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Submitted to the Faculty of the Graduate College
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in partial fulfillment of the requirements
for the Degree of
DOCTOR OF EDUCATION
May, 1973

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ACKNOWLEDGEMENTS

I would like to express appreciation to the members of my doctoral committee; to Dr. Ken Wiggins, the chairman, for all that he has done to help me both personally and professionally; to Dr. Ted Mills for his active participation and counsel in developing the study; to Dr. Russell Dobson for trusting me; and to Dr. Herbert Bruneau for his interest and enthusiasm for the project.

My whole graduate program and particularly this study got started in Matt Story's office at the Manned Spacecraft Center and I appreciate all that the NASA Space Science Education Project has done for me. Matt Story, Ev Collin, and Ken Wiggins facilitated my efforts at every turn and Bob Workman, Berta Danford, and Jim Poindexter were never more than a phone call away. In addition, the NASA Educational Programs staff and the Space Science Education Specialists helped me far more than they realized with publications, activities, and other support. Professionally, I never felt alone.

Thousands of teachers helped in developing the activity pool I had at my disposal and hundreds of workshop directors saw to it that they were made available. There is a little bit of all of them in the product.

Judy Jones, my best friend, wife, and mother of my son, Jonathan Bennett, typed the many roughs while Ruth Henry prepared the final draft.

Finally, my parents, Randol and Virginia Jones and Judy's family, the Dement clan, stood by to help me any way they could. Personally, I never felt alone.

As a matter of fact, I felt great during my whole graduate program and I think that's probably what education is all about, feeling good about yourself and what you do.

I humbly realize that I feel this way because of these people I have named and many more that I haven't. However, they know who they are and how they have treated me. I have been the beneficiary of an extremely high quality of human relationships and I only hope I can share this bounty with many others in the years to come.

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PRESENTATION OF THE PROBLEM

Introduction

Inservice education has become an integral part of attempting to improve the instructional program in many present day schools. The reasons for this situation are varied. Some inservice education is teacher initiated with impetus from professional organizations. The NEA platform states: (36)

> In every classroom a teacher with a broad general education, depth of preparation in special areas, mastery of the knowledge and skills necessary to be a competent teacher, and zeal for continued learning.
>
> Encouragement--through professional and sabatical leaves, scholarships, salary policies, and income tax deductions for educational expenses--for teachers to maintain and improve professional competence.

Fullerton (13) has very succinctly enunicated the rationale for inservice education in this statement:

> Good schools can always be better, and competent teachers can always improve. Essentially, continuing teacher education exists to meet the challenge of providing an increasingly better education for the students in the schools. There is an urgent need for teachers to be familiar with relevant research and recent developments in education. They must see the implications of the findings and developments for application in their classrooms. There is also a need for teachers to refine their teaching skills.

Professional organizations and teachers are not the only forces in initiating inservice education. Other factors are combining to demand that the inservice teacher spend an increasing amount of time updating his skills and acquiring new knowledge. The most recent factor to combine in this synergistic relationship has been the development of the management procedure known as accountability. Within the past few years, the public in general and school boards in particular have rapidly grown aware of the concept of accountability in the educational process. Lessinger (25) has defined accountability as "...the comparison of what was supposed to happen with what did happen." Most educators interpret this statement in terms of learning outcomes in relation to educational objectives. However, school boards are also stressing the accountability of fund expenditures in relation to the teacher work year. Therefore as teacher organizations continue to negotiate for new salary structures with school administrators, more and more often the results emerge as a trade off. The improved structures are granted in return for extended school terms. In many cases the extra days above the pupil attendance requirement are devoted to some form of inservice education.

In the past, these inservice education experiences have been of a varied nature and educational quality. Short courses, lectures, field trips, media presentations, and other stimuli have been used to offer "refresher" training to returning teachers or teachers undertaking new assignments, to foster improvement of the teaching practice, and to present proven advances in theory or practice. However, inservice teachers are often burdened with housekeeping and administrative tasks outside of school hours. They often have little choice in selecting what topics will be presented in inservice sessions and they are required to meet at a prescribed time, often without renumeration, and after school hours, to undertake such activities. Polonski (38) describes the conditions desireable for a meaningful inservice education program:

> Obviously what is needed is a relatively painless approach to in-service education: one which would be teacher-initiated and teacher-dominated; one which requires a minimum of organization and red tape; one which can be pursued within the regular teaching day; one which is strictly voluntary; and one which makes no formal demands upon the teacher, other than that he be an interested participant.

Polonski's statement has been echoed by many teachers claiming that most present approaches are ill planned, administratively required, and irrelevant.

A survey of techniques and media which could meet the requirements of "teacher centered inservice education" reveals that closed circuit instructional television (49) has the greatest potential of all teaching systems for meeting these criteria. This medium has been one of the most widely researched innovations in educational technology. Appearing on the scene soon after World War II, television was proposed as a cure-all for our expanding school population and decreasing teacher force and large sums of federal and private funds were made available for instructional television research (11). However, the results of this large body of research have been largely inconclusive. The variables examined have consistently yielded results of no significant difference. Surveys and reports concerning the situation have been compiled and analyzed and even reports on these reports have been presented and critiqued. The question that now faces the educator concerned with instructional television is how to sort out and effectively organize the proven strengths of this medium to produce meaningful and measureable change in inservice teachers while meeting Polonski's criteria for teacher centered inservice education.

Statement of the Problem

The large majority of studies in instructional television deal with comparing a face to face presentation by a teacher with a televised presentation by a teacher. In addition, many production variables have been examined and a broad spectrum of subject matter has been utilized. Basically, two presentation formats have been employed. Open air broadcasts require the viewer to utilize the video program in accordance with a predetermined time schedule. Closed circuit television (4) can utilize a video tape recorder to present the program when the viewer desires it.

This study will take the approach that highly specific planning must be instituted to produce closed circuit instructional television units which will be effective. This planning must consider the specific population in which behavior change is desireable, the exact terminal behaviors desired, and the production constraints of the instructional television medium. Behavior change by the persons exposed to the television units must be demonstrated and evaluated and attitudes toward the concept of teacher centered inservice education must be measured. If instructional television units can be designed, administered, and evaluated to meet these goals, the results of the study might have significant consequences for inservice teacher education, particularly in the area of demonstrable skills and concepts.

The purposes of the study will be: (a) to utilize system analysis techniques for developing a model for inservice education video tapes; (b) to produce a series of instructional video tapes based upon self expressed needs of a teacher population; (c) to utilize the communication or feedback loop of the proposed model to further refine the system.

Research Questions

1. Can a design model be developed which will produce video tapes based on expressed needs of inservice elementary teachers?

2. Will the video tapes produced under this design model produce observeable viewer behavior change?

3. Will inservice teachers respond favorably to the concept of instructional television units as a basis for teacher centered inservice education?

4. Will the validation population of aerospace education experts consider the content of the video tapes as adequate?

Limitations of the Study

This study is concerned with the design and refinement of a model for developing instructional television units. The rationale underlying the development of this instructional system dictates that it be designed for a homogeneous population, in this case elementary inservice teachers with an expressed interest in developing curriculum units in aerospace education. Consequently, in terms of generalizeability, this study by design will be very limited.

Significance of the Study

The proposed theoretical model for developing instructional television units is designed to produce specific results with specific populations. If it is possible to formalize such a system, produce video tapes consonant with system objectives, and no significant problems develop in production or viewing, then this technique could have significant possibilities in teacher inservice programs. It theoretically would be possible to have a completely teacher controlled inservice program based upon expressed teacher needs. The factors of time, location, and subject matter relevance would be teacher centered. This in turn would result in better trained teachers with more positive attitudes in more classrooms.

Definition of Terms

1. Behavioral Objective is defined as a statement of the behavior a learner can be expected to demonstrate when he has achieved that objective. Each behavioral objective will have the following six elements either clearly stated or implied:

a. The person who is to exhibit the behavior.

b. The observeable performance or action that the learner is expected to exhibit.

c. The conditions, objects, and information that will be given before the learner exhibits the desired behavior.

d. Who or what initiates the performance of the behavior of the learner.

e. The behavioral responses of the learner that will be acceptable.

f. Any special restrictions that are going to be imposed on an acceptable response by the learner, i.e., time limits.

2. Inservice Education is defined as learning activities undertaken by inservice teachers.

3. Aerospace Education is defined as the study of concepts, skills, and activities involving space science and aeronautics.

4. Instructional Television or Educational Television is defined as a video program utilized for instructional purposes.

5. Closed Circuit Television (CCTV) is defined as a system which will allow the user to determine when the video signal will be utilized. A CCTV system is composed of a VTR, video tape, and television monitor.

6. Instructional Television System is defined as a series of televised instructional units and supportive materials designed to produce specific behavior changes.

7. Video Tape Recorder (VTR) is defined as a device for playing a video tape for display on a television monitor.

8. Video Tape is defined as a magnetic tape capable of storing symbols for visual and audible reproduction of a CCTV system.

9. Mastery Learning is defined as an educational technique which allows the learner to repeat instructional treatments as often as desired until a specific goal is fulfilled.

10. Systems Analysis is defined as a management technique specifically applied to the problem of developing instructional units to achieve behavioral change. The technique will include the serial steps of population identification, needs assessment, media analysis, media production, implementation, and evaluation.

11. Population Identification is defined as an early planning step necessary to determine who will best benefit from a proposed program.

12. Needs Analysis is defined as a planning step to determine the basic level of knowledge or skills within an identified population.

13. Media Analysis is defined as a decision point based upon the planning steps which will determine if the defined needs can be met by an instructional television unit.

14. Production Subsystem is defined as a complete system which produces an instructional television unit designed to achieve specific objectives.

15. Evaluation Subsystem is defined as a complete system which matches viewer performance against performance objectives and provides for modification of one or more of the elements as needed.

CHAPTER II

REVIEW OF SELECTED LITERATURE

A Wealth of Confusion

Educational television has received a great deal of attention and study from researchers. However, the research has been of a varied nature and quality with very few developmental programs. This has resulted in a tremendous amount of published results with few clear cut findings. Gordon (15) after twenty years of participating in educational television research made this statement:

> Needless to say, the fruits of this "scientific" outburst have produced a quantitative glut, probably the largest ever accumulated anywhere concerning a single educational methodology or teaching instrument.

One reason for the large quantity of research in this area lies in the history of the medium of television. In a report issued in 1961, the historical factors for the quantity of research were given:

> Since the end of World War II, the numbers of births has risen more than fifty percent, and each year for the past five years it has hovered around the four-million mark, ...Enrollments have risen steadily at all levels of education, and as wave upon wave of new students have swept upward through the grades, educators have come to realize that this is not a temporary phenomenon, but a problem- and a challenge- that will be with us for the foreseeable future.
>
> Coupled with the rapid rise in enrollments has been an acute shortage of able teachers. Since the end of the war, the number of new college graduates entering teaching has not kept pace while the number of poorly qualified teachers hired each year has remained distressingly high... .

> One of the most promising tools for attacking many of these problems has been television, the most powerful medium of communication yet devised by man (11).

Five years later after a nationwide experiment, the same organization, the Fund for the Advancement of Education, published a second report. The first paragraph of this report stated:

> After more than a decade of intensive effort and the expenditure of hundreds of millions of dollars, has television made a real impact on America's schools and colleges? Has it made a worthwhile contribution to education?
>
> The short answer to such a sweeping question would probably have to be "No". Whether measured by the numbers of students affected, or by the quality of the product, or by the advancement of learning, televised teaching is still in a rudimentary stage of development. The medium can take credit for helping understaffed schools to cope with ever increasing enrollments. But television has not transformed education nor has it significantly improved the learning of most students. In short, TV is still far from fulfilling its obvious promise. Television is in education all right, but it is still not of education (30).

Recent critics have expounded upon this point. Kitross (22) in a survey of hundreds of studies funded under Title VII of the National Defense Education Act of 1958 reported that in relation to learner outcomes, "To our initial surprise and later disappointment, we found over and over agin that there was no significant difference between televised and conventional instruction."

Other researchers have had similar experiences. Chu and Schramm (9) in a monumental survey and analysis of research made this comment concerning the lack of clear cut results in educational television research:

> In a sense, instructional television is more complex than the research that deals with it. Complex behavior has baffled learning theorists for years. A number of variables are clearly at work in determining what a given individual learns from television. In many cases these variables interact, and the total must be a great deal more complex than

> can be represented by the one-variable experiments that typically make up the research literature, no matter how clean and skillful they are.

This statement revealed the basic weakness of most of the experimental studies in instructional television. Although studies have been made on black and white and color, with and without sound, music, with professional actors and amateur teachers, and in every subject area imaginable, nearly all of the results showed no significant difference in the variables under study. Quite possibly differences existed, but complex interactions clouded them.

Laurence Siegel (41) has conducted studies for fifteen years to try to arrive at a new paradigm for instructional method comparisons. He too was motivated by results similar to those already noted:

> When I joined the staff of Miami University, my purpose was to design and execute a series of evaluative studies to answer the general question: "Is large group instruction (lecture, televised, etc.) as effective and efficient as small group 'conventional' instruction?" This was over ten years ago; ...Four years and a quarter of a million dollars later, we were able to say that students appeared to learn as much - or as little - regardless of <u>how</u> they were taught.

Gordon (15) combines the two major criticisms of inadequate design and complex interactions in this statement:

> The causes for this curious state of affairs are many, and they cannot be expanded here. They relate to improperly posed research questions, shoddy methods of procedure, and mostly, the tendency of students in schools on all levels to try to make sense out of what they are studying - and to learn as much, as well as possible - despite <u>one</u> missing variable like a text, a prerequisite course or even a good teacher. I have arbitrarily called this tendency "Gordon's Hypothesis" in honor of its discoverer.

Today, we no longer face a teacher shortage. We are not nearly so concerned with population explosions and the teacher should not be threatened by replacement with an electronic counterpart. However, there is little new knowledge contained in the literature that began with Ford Foundation and government funding when we did have teacher shortages and a "baby boom." This in turn has reduced the urgency which underlied the television versus face to face lecture research. It is possible that due to design inadequacies beyond control, this research should have ended much sooner. Chu and Schramm (9) have pointed out this difficulty:

> ...test results from the TV group and the face-to-face groups would, strictly speaking, be comparable only if the students are assigned randomly and in such a way as to minimize the reactivity of the experimental arrangements, if the qualities and performance of the teachers are in every way the same, if the contents of the lectures are the same, and if the learning environments are the same. Only then can we be reasonably sure that we are comparing the effect of presenting a lecture on television with the effect of presenting the same lecture face-to-face.

Stickell (44) in 1963, surveyed some two hundred fifty comparisons and found only ten which met the rigid requirements of adequate experimental design. He reported the great majority of the studies to be "uninterpretable" due to design inadequacy.

Chu and Schramm (9) took a more liberal view of this body of research and published their survey with the cautionary statement:

> ...shall we use them for what they are, namely, research findings that do not strictly meet the requirements of methodological rigor but nevertheless may provide some information on a pertinent research problem?

This appears to be the only logical approach to follow. By examining the particular needs of a learning situation, a decision can be made as to what media is appropriate. Educational television has certain well documented strengths and weaknesses which have not been fully considered in many of the studies reviewed, consequently, the result of "no significant difference" has become almost a foregone conclusion.

Consequently, it becomes the researcher's task to become more critical, to define more precisely, and to apply the strengths of the medium to a particular research problem while insuring a minimum effect from its weaknesses.

The Inservice Literature

With all the problems involved in instructional television research design, and the common result of "no significant differences" found in matched group studies, it is of interest to report the results of the medium as it has been applied to inservice education.

Burger (5) matched two groups of seventeen fifth grade teachers and gave each teacher a Science Guide. In addition, one group viewed three half-hour ITV programs on science subject-matter before presenting lessons on the same topics. 1,039 fifth grade pupils were involved in lessons taught by the two groups and all were pre and post tested on electricity and machines. Post tests indicated that pupils of teachers receiving instructional television instruction scored significantly higher on the electricity unit than the control group. However, there was no significant difference in the scores on the machinery unit.

Castle (7) utilized open-circuit television to present specific medical information to medical students and inservice doctors. The problems of utilizing open-circuit television were evident in the small percentage, 19 percent, of doctors who viewed each program. However, a test group of 23 physicians and 33 medical students showed large gains in knowledge concerning the topic broadcast. The Burger and Castle studies (5) (7) show that something can happen. However, the lack of specific objectives precludes discovering exactly what factors caused the learner responses.

Frazier and Evans (12) presented ten half-hour ITV lessons on elementary science to 4,814 third and fourth grade pupils and their 151 teachers. Teachers were administered a pre and post attitude questionnaire and twenty of them were interviewed. They were also asked to complete an 18-item evaluative questionnaire. Fourth grade students took the STEP test. Teachers significantly increased their feelings of confidence in teaching elementary science at the .01 confidence level. They also reported pupils showed more interest in science, asked a wider range of questions, and brought more material to class. The STEP test results showed no significant differences. The half-hour program format was considered too long for fourth grade attention spans.

Hunt (18) presented fifteen half-hour reading instruction programs to four groups of elementary teachers in Pennsylvania schools. Attitude questionnaires and self-reports were used for evaluation. The results showed that the ITV reading programs significantly affected the observed classroom performance of teachers, and had a significant positive effect on changing teachers' attitudes toward teaching reading. Teachers reported significant changes in their activities and viewing parents reported changed attitudes. However, there was no effect on pupils' reading achievement or attitudes. This study along with the previous one points out that teacher attitudes can be made more positive in relation to subject matter and teacher confidence can be increased. It is interesting to point out that in both studies, while the teachers were effected, no measureable changes were noted in their pupils.

Popham (39) designed a study to test the relative effectiveness of four video taped instructional programs formulated with specific teacher behavioral goals. The research design allowed for contrasts among individuals who received no instruction, brief instruction, and brief instruction plus video taped supplementary instruction. Results of the experiment indicate that significant differences were produced in favor of the group exposed to the video taped programs.

Welliver (47) reported the results of using educational television in science supervision. North Carolina has used television for both student instruction and inservice teacher education. Several studies have been conducted in this project and significant teacher change has been observed. Teachers reported they learned not only from the programs designed for them but also from the programs designed to instruct pupils. Welliver concludes that educational television can make a significant impact upon all areas of instruction important to science supervisors.

Klabenes and Spencer (23) in reporting the results of a government funded video inservice program in Nebraska stated that by using carefully planned objectives, teachers could modify an undesired target behavior by utilizing video programs designed for specific pruposes. This study, Popham's work (39), and Welliver's description of the North Carolina program (47), point out the benefits of utilizing specific objectives with specific populations in designing instructional television programs.

An Evaluation

The question arises as to why in hundreds upon hundreds of matched group studies in widely varied situations the results were reported as "no significant differences." This question is to a large extent answered by the critics Gordon, Kitross, Chu and Schramm, and Siegel with their well documented claims of simplistic reduction, criterion inadequacy, and unidimensional research designs with no allowance for interactional factors.

A second question evolves from the first. Why do teachers seem to learn and exhibit changed behavior in a majority of the studies involving the use of television in inservice programs? Is this simply the most sophisticated application of "Gordon's Hypothesis?" Probably this is not true. Instead a clue is given in this statement from B. F. Skinner (6), "one difference between training and education is that trainers know what they are doing." A closer analysis of the massive literature points this out. Where highly specific objectives have been defined as in the Popham and Klabenes and Spencer studies (39)(23), where validation procedures have been used to evaluate the attainment of these objectives as in Welliver's report (47), there significant learning has occurred. The inservice research presented here is evidence of significant applications of educational television with inservice personnel and as such it points out specific strengths for the design of television inservice programs.

CHAPTER III

DESIGNING AN INSTRUCTIONAL TELEVISION UNIT

The First Clue

As pointed out in Chapter II, educational television research has suffered from what can only be termed an egocentric viewpoint. In other words the utilization of educational television has been goal oriented rather than requirements oriented. Educators, for one reason or other, have proposed educational television as an alternative for some other method of instruction. For the most part, little time or effort was spent in studying the nature of the medium or the needs of the group viewing it. Instead, a traditional experimental design was usually implemented to try to discover if educational television could do a better job than face to face instruction. In nearly every case, the results were reported as not significantly different. In analyzing the very small number of cases reporting significant differences in favor of educational television, many of them were found to be directed at populations of inservice teachers. On the surface this might first appear that educational television has some particular effectiveness for this particular group. However, a further analysis indicates the complexity of this situation. Inservice teachers have needs and interests of a much narrower scope than a randomly selected group of undergraduate students. In addition, several of the inservice programs were designed to produce specific results in specific groups of teachers. This situation implied that possibly by systematizing the techniques of the successful studies, a model could be designed to produce favorable and significant results at every application. This chapter will present the elements necessary for the development of such a unit.

The Systems Approach

Educators are being exposed to systems analysis as a management technique in many aspects of education. As one example, due to Office of Education requirements, a specific system must be utilized in applications for federal funds. This of course is only one model within the possible choices and was made for administrative purposes. However, many educators do not realize the flexibility of systems so the following paragraphs deal with the systems approach to problem solution in a broader and more theoretical context.

John O. Aberg of NASA's Central Systems Engineering Directorate at Marshall Space Flight Center in Huntsville, Alabama has spent a great deal of thought and time in generating a general philosophy of systems with both technical and sociological applications. The following material is abstracted from a series of presentations made by Mr. Aberg during the Aerospace Research Seminar at Shawnee Mission, Kansas during June, 1972.(1).

Aberg defines the systems approach as basically a way of attacking a problem or situation. It involves concentration on the whole rather than the parts and insists on looking at the problem in its entirity. It is often wrongly assumed that the systems approach is a computer program, a block diagram, a set of equations, or a particular methodology. Nothing could be farther from the truth. It is a philosophy, an approach based on logic and common sense, to be coupled with specific problem solving tools. Aberg states that although there are specific tools and procedures that recur in establishing systems, one should not let himself be limited by these known tools, rather the problem should be allowed to develop new problem solving tools or modify old ones within the philosophy.

The thrust of Aberg's argument is to establish the fact that there is no "the systems approach" but rather specific approaches for specific problems. Further understanding of this philosophical consideration comes from Aberg's definition:

> I like to define the systems approach as an orderly and exhaustive method to examine a system as a whole and to logically subdivide it into elements; and to determine the functions to be performed by each element.

He continues with the thought that man tends to think in terms of goals as opposed to requirements and the systems approach means limiting or eliminating solution thinking while developing a set of requirements.

While diagrams and flow charts necessarily limit the flexibility of a systems approach by applying it to a concrete situation, Aberg presents the following model as applicable to many situations.

The importance of this diagram is twofold. One, systems evolve from needs and two, emphasis should be placed on the planning phase.

Given these considerations of the systems approach as a philosophy as opposed to a technology, it is of interest to examine contemporary applications of the systems approach to curriculum development.

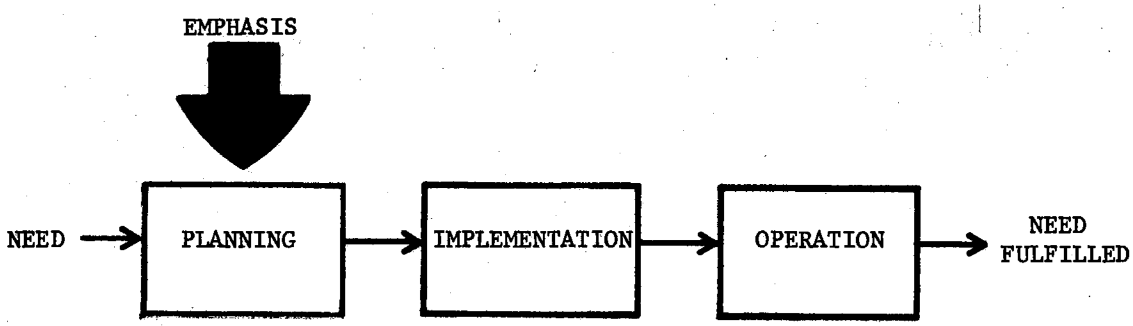

Figure 1. Aberg's Simplified Flow Chart for General Cases

Systems Analysis in Curriculum Design

Systems analysis as a management technique was first used to solve complex engineering problems. In the last twenty years, due mainly to the success and popularity of our space program, the systems approach to problem solving has enjoyed renewed interest by investigators in many areas. Consequently, social scientists and educators have worked to apply this technique in areas of their concern. Specifically, instructional technologists have experimented with the technique as a device for curriculum design.

Oines (37) gives a simple but straightforward definition of a system as it is most often applied in curriculum development:

> A system can be defined as the set of components, or subsystems, that are brought together to function as an integrated whole for the purpose of the accomplishment of its objectives. Two characteristics of systems are 1) all systems can be viewed as subsystems of another system, and 2) it is always possible to determine whether or not a system has functioned, or is functioning, properly.

A humorous cartoon appears in the official NASA history of Project Mercury. It showed two astronauts on top of a launch vehicle just prior to lift off. One of them turns to the other and says, "Doesn't it scare you that this system consists of over 200,000 components made in 20,000 different locations and they all have to work the first time?" The other astronaut replies, "That doesn't bother me as much as the fact that all those parts were built by the lowest bidder." This anecdote points out the fantastic capabilities of the management technique known as systems analysis. Project Apollo serves as a highly successful example of a large scale application of the strategies necessary to complete a complex space mission. It also furnishes useful information to anyone concerned with solving complex problems, whether in space, traffic control, pollution abatement, or curriculum design. The Apollo system was given one total design objective, to successfully land men on the Moon and return them to Earth. This objective came from a needs survey of the United States public through congressional and executive action. A time constraint, specified in years, and a monetary constraint, specified in dollars, were imposed. Based upon these considerations, the production subsystem was established and production of the launch vehicle, spacecraft, launch support, and other necessary components was undertaken. Finally test results were compared against system objectives to refine the hardware. At the final step, all subsystems were integrated, the system tested in progressive steps, and the total design objective achieved.

Apollo, for the most part dealt with machines and physical components. The question logically arises as to whether systems analysis can be adapted to curriculum design with its high involvement of human factors. Aberg and Oines both argue that when the complete approach is abstracted, human factors are, indeed, accounted for. This consideration was a basic assumption of the study.

The Behavioral Objective

From our earlier definition of systems it is evident that they exist only to satisfy their objectives. The most important element in both designing and evaluating an instructional system, is the stated objectives of that system. Only recently has a method of stating precise, observeable instructional objectives been developed.

One of the most powerful and least understood tools developed for the curriculum builder during the 1960's was the "Behavioral Objective." Psychologists of learning observed that if a desired instructional outcome could be stated in terms of the behavior which a subject will exhibit as a result of being exposed to an educational experience, then the learner's terminal behavior can be inspected to evaluate the effectiveness of the instructional system. Mager (27), Walbesser (46), McAshan (28), and Gagne (14) have discussed the rationale and desirability of using behavioral objectives as planning elements for a curricular system.

However there is a philosophical consideration to the use of behavioral objectives that many curriculum engineers have ignored. Block and others (3) have stated that the greatest recurring problem in instructional systems today is that of "procrastination." That is although objectives, learning activities, and evaluation exercises are very explicitly outlined for the learner, in many cases he still will not involve himself in the learning process. There is some evidence to show that these procrastinators are individuals who feel no specific need for the material presented. Therefore, a more complete model must evolve than the simplistic one utilized in most contemporary instructional systems.

Aberg's model stated that emphasis must be placed on the planning phase in the development of a system. Even more important, any system must be imbedded in a matrix of needs. Therefore a logical step in making instructional systems more efficient is to inspect the population under consideration for particular needs. When a population is specifically defined and its needs precisely documented, then the behavioral objectives used as design criteria will be the expressed objectives of the learner and not those of the curriculum engineer.

These theoretical considerations form the basis for a new approach to the development of curricular systems. The first step is to establish instructional priorities based upon the expressed needs of specific populations. Then terminal objectives using a behaviorally observeable format can be stated for all expressed outcomes and logically sequenced. Once this step is completed, the goals of the production subsystem have been defined.

Mastery Learning

When objectives have been clearly defined, and a presentation sequence selected, CCTV systems allow the implementation of a recent and innovative concept in educational practice. Historically, the variable of time has been critical in the instructional situation. Recently, researchers in individualized instruction have begun to experiment with the variable of time. By not controlling this variable, that is by allowing learners to spend as much or as little time required to achieve terminal behaviors, it theoretically becomes possible for all learners to exhibit a predetermined level of mastery of the desired behaviors. Block, Bloom, Carroll, and Airasian (3) have presented the theory behind this promising innovation and reported numerous studies utilizing the operational concept of "Mastery Learning". One strength of CCTV systems is that they provide the viewer the opportunity to utilize mastery learning techniques.

The Video Tape Recorder

In order to implement mastery learning in instructional television, the closed circuit concept which allows a television instructional unit to be presented at the viewer's will is necessary. The video tape recorder or VTR is an ideal medium for presenting material for mastery learning. Not only can the instructional program be instantly stopped, reversed, and rerun but the capability exists for the video image to be frozen in action at the viewer's option. This capability will allow complete freedom of manipulation of the time variable in obtaining information from instructional television.

Video tape recorders or VTR systems have been in use in large production studios for many years. However, the development of inexpensive, reliable VTR systems which are readily available to schools has occurred only recently.

Design of the Instructional Television Units

The elements previously mentioned are sufficient to generate a theoretical model for the production of instructional television units. However, at this stage, there is no guarantee that the units will be meaningful to their viewers. The Great Plains National ITV Library has concerned itself with this problem in its Project ASERT for several years and recently produced a design system based upon its experience (25).

> In its gropings, Project ASERT came to the realization that to produce an instructional product that could be measured in terms of actual student learning gains, project efforts would have to shift from <u>producing television</u> for instruction to <u>designing instruction</u> for television.

This statement though short and simple is the rationale for a whole new era in instructional television production or as it should become known, instructional television system design.

Several pilot studies were conducted on elements of an instructional television system during the spring of 1972. As each subsystem was determined from requirements, it was operationalized in one or more video tapes. By trial and error, a rough system was designed and utilized to produce a trial video taped program. This program, "Maintaining the Aquarium" was produced in two different formats and a paper and pencil evaluation form was designed to assess the strengths and weaknesses of the design system. Several different populations viewed the program in one or the other format and data was gathered on each element of the proposed design system. The culmination of this subsystem testing was reported in An Evaluation of the In-Service Video Tape - Maintaining the Aquarium (21). Briefly summarizing, with both in-service teachers and curriculum consultants, concepts and skills were gained from a video tape designed in consonance with specific objectives. The total concept achievement is reported in Appendix E, and it is interesting to note that the mean achievement of the combined groups was above the 90 percentile. Based upon this pilot data and the theoretical and logical considerations of systems analysis techniques as expressed by Aberg and Oines, a final design model was developed for the study. The following paragraphs list, describe, and explain the functions of the elements of the model.

Identification of Population

The theoretical rationale for the inclusion of this element was found in the review of the literature. Siegel (41), Gordon (15), and others pointed out that many of the studies reported during the last twenty years had suffered from criterion inadequacy. Part of this inadequacy derived from the large intra group differences which existed in their study populations. The Burger (5) and Castle (7) studies pointed out that significant learning can occur with groups such as inservice teachers that are homogenous in training, experience, and work assignment. This theoretical rationale was reinforced by experiences with the pilot program "Maintaining the Aquarium." When the video tape was presented to populations with diverse training and work assignments, differences in achievement were readily apparent.

Population Needs Assessment

"Needs assessment" has become a popular term in education, due mainly to the requirement to attach such a procedure to applications for many sources of federal funding. While the term has enjoyed this wide spread popularity, some doubt exists that many true assessments have been made. There are many methodologies for obtaining a needs assessment for a specific population. These range on a spectrum from one person simply writing down what he thinks would be good for a certain group to a thorough polling of all members of this same population. For this particular study, all efforts were made to achieve the most complete and honest needs assessment feasible.

Media Analysis

Aberg stated that in a systems approach at no time should the system developer commit himself to an end product until all requirements had been gathered and all trade off studies completed. The media analysis step enforces this point by asking the question, "can the identified need be mediated by instructional television?" At this point, the system developer meets with media and content specialists to ascertain whether a body of content exists that will satisfy the expressed needs and is instructional television competitive with other media for presenting the designated material. At this decision point, the needs which can be mediated on the instructional television format can be rephrased as terminal performance objectives. These in turn define the planning objectives of the Instructional Television Unit Production Subsystem.

Development of Instructional Strategies

One criticism of instructional television that has great meaning is that it is a one way medium. Chu and Schramm (9) found this to be a common element in explaining the failure of many studies. It became an objective of the pilot studies to minimize this factor. Accordingly, each of the identified activities was operationalized and presented first, not on instructional television but face to face, to elementary teachers and students at Skyline, Lincoln, Westwood, Highland Park, and Will Rogers schools in Stillwater, Oklahoma and at Ripley Elementary School, Ripley, Oklahoma. The strategies that evolved from this face to face experience were finalized for utilization in the production of the instructional video units. The face to face experience was extremely valuable in refining the techniques which were to be used on television and therefore assisted in overcoming the well documented "one way only" weakness inherent in the instructional television medium.

Integration of Production Constraints

The systems approach philosophy states that a goal will only be obtained in terms of the consideration of defined requirements. This philosophy requires the consideration of options in what are commonly called trade-off studies. A trade-off study became necessary in evaluating each activity's adaptability to instructional television. The decision of the trade-off study would answer the question, "Do production constraints prohibit the development of an instructional television unit?" Here each activity is evaluated by the system developer and professional television production staff on the criteria of clarity of communication, space requirements, lighting requirements, special filming requirements, and other production constraints. If the activity is considered inappropriate for video taping, it is rejected and other media techniques are considered. If the activity is considered appropriate, then a script can be developed and production of the instructional television unit can proceed.

Evaluation of the Instructional Television Units

After the total instructional package of video taped units and supportive materials has been developed, it is possible to evaluate not only the ability of the video tapes to achieve their design objectives but to also iterate or change any subsystem or element of the total system. The original design objectives can be restated as evaluation activities (Appendix D). After viewing the tape, viewers of the design population can attempt the activities and an immediate overt measure of success can be obtained. At this point, the mastery learning capability of the CCTV system becomes very important as the viewer can freeze or rerun any portion of the instruction which he desires. The decision point following the evaluation of the observed behavior asks the question, "Has desired level of mastery been achieved?" If the response to this question is positive, then the viewer can proceed to viewing the next unit. If the answer to the question is negative, a discrepancy analysis becomes necessary.

The Discrepancy Analysis

The rationale for the inclusion of this element of the design system was established by Aberg who stated that any system must be capable of iteration or controlled and accountable change. The results of the pilot studies reinforced this position as several planned objectives were perceived in another manner by viewers. Therefore, the discrepancy analysis element is a step which allows for a spectrum of actions. The purpose of any of these actions is to improve the effect of the instructional television unit. The actions may range from simply adding a footnote to a supportive teaching guide to completely replanning and retaping an instructional unit. Usually the discrepancy correction occurs in the form of editing in or out some particular segment of an instructional unit. When this has been completed, the instructional unit may be re-viewed by the design population

Integration of the Elements

One of the strengths of the systems analysis technique is the logical flow of events from element to element. This allows for any system to be represented in the visual format known as a flow chart. The flow chart for the integration of the previously described elements is presented here.

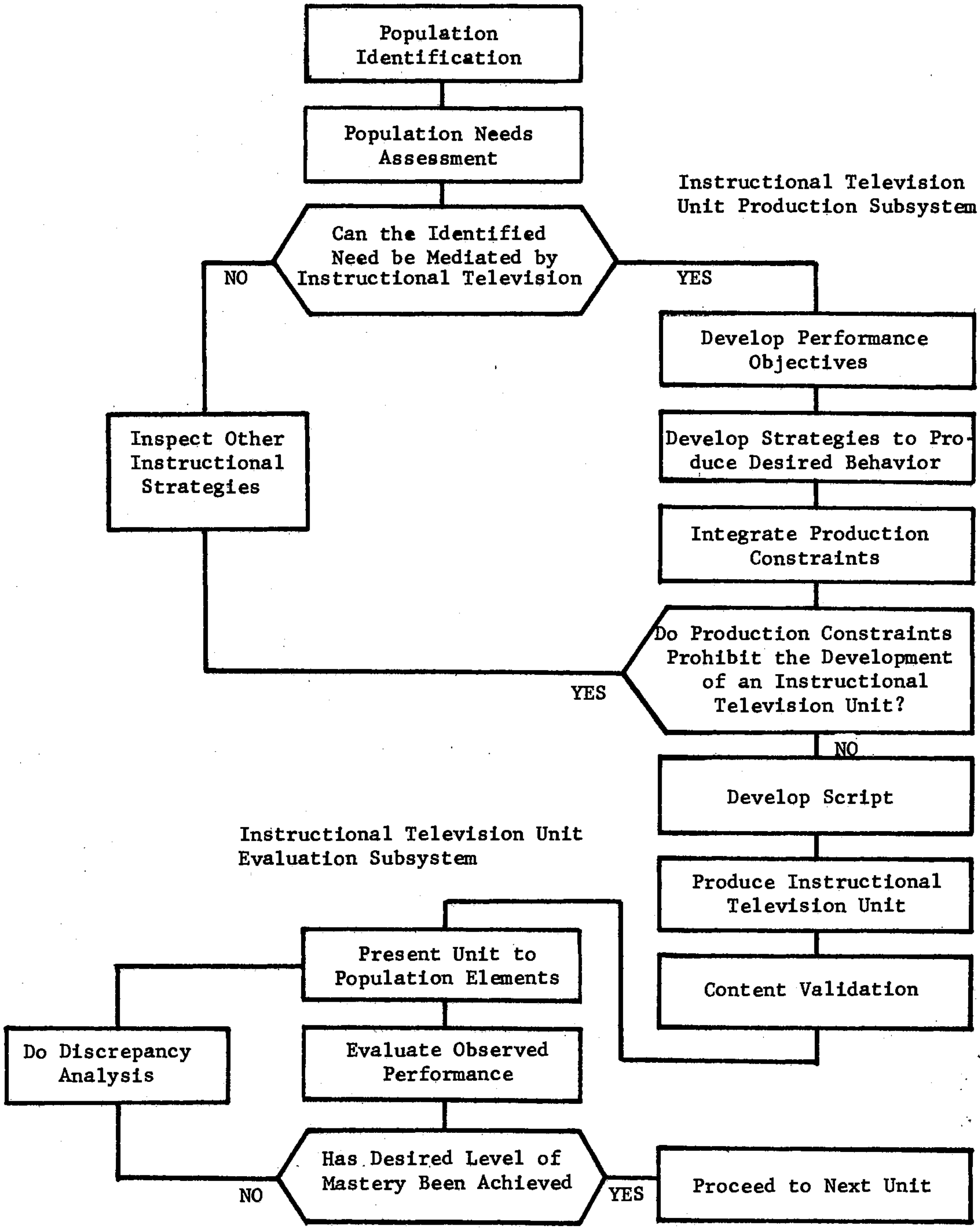

Figure 2. Instructional Television System Integration Flow Chart

CHAPTER IV

VALIDATION OF THE MODEL

The main thrust of this study was to develop and validate a theoretical design model for instructional television units applicable to the concept of teacher centered inservice. However, to analyze any discrepancies in the design system, it was necessary to administer one or more of the units to elements of the population it was designed to serve. It was also of interest to obtain information from the participants concerning their opinions toward the instructional method. No statistical inferences were to be drawn from the data. Instead the information was used in a discrepancy analysis mode to refine the instructional television units and supportive materials. This resulted in video tapes which may at first appear to be the same as any other video tape. However, the underlying design system ensures that these video taped instructional units differ in significant ways, for each step in their planning, production, and evaluation is accountable and subject to iteration to achieve consonance with its planned objectives.

The rationale for exploratory studies of this nature has been stated by Jahoda, Deutsch, and Cook (20):

> It goes without saying that the establishment and verification of hypotheses remains a goal of scientific inquiry. Yet there is not short cut to this goal. In many areas of social relations significant hypotheses do not exist. Much exploratory research, therefore, must be done before hypotheses can be established. Exploratory work not based on precise hypotheses is an inevitable step toward scientific progress.

Hopefully by developing instructional television units to answer specific needs of specific populations and by recording descriptive feedback, hypotheses can be generated concerning applications of the design model.

Needs Analysis and Population Identification

Aberg (1) in his discussion of the general systems model states that all systems must be capable of iteration. In other terms, a system must be capable of change in response to the feedback of its own output. Therefore, to refine the proposed model it was necessary to apply it to a specific situation and utilize the output as design feedback. The results of this application would be utilized to test the integration of the total system.

Possibly the most difficult step in curriculum system design is to procure a meaningful needs assessment. In none of the studies reviewed, was any process of this nature employed. In testing the model, a survey of aerospace workshops conducted by Helton (16) during the summer of 1970 was utilized to both identify a population and assess its needs. Helton's study involved distributing questionnaires to participants in 110 aerospace workshops throughout the United States. From the 79 workshops which returned useable data, 2,003 participants responded. 1,238 of these respondents were involved in elementary education. In a summary report he presented the following statements:

> VII. Overall, workshop participants consider Manned Space Flights as the most informative topic for future reference in classes followed by benefits to mankind and future space exploration (Q32). Elementary teachers favored the topic of Manned Space Flight, Junior High teachers favored aeronautics, and Senior High teachers favored the topic of scientific programs (32:13). Aeronautics was considered as

the topic most easily included in subjects the teachers taught (32:35) but the content of presentations concerning Manned Space Flight was most appropriate for teachers (32:37).

VIII. Teachers indicate NASA should emphasize appropriate classroom activities far more than materials or resource people (Q23). Science teachers indicated NASA should emphasize materials the most, (23:12). Over two thirds of the teachers who indicate activities should be emphasized are in elementary education, (23:12).

Utilizing these results, elementary teachers were selected as a target population and appropriate classroom activities as a defined need.

The Media Analysis Process

NASA Educational Programs division has published several curriculum supplements containing many appropriate classroom actitivites (31)(32)(33)(34)(35). The Civil Air Patrol, Federal Aviation Administration, and various aviation related industries have also published tested activities and supportive educational materials (29)(8)(2). Many of these activities have been presented and refined in the hundreds of aerospace workshops presented in the past 25 years. This body of published materials was surveyed and analyzed in terms of the ability to meet the expressed needs of the elementary teacher population and thirty candidate activities were selected for further analysis in the production subsystem.

Production of the Video Instructional Units

The primary product of the design model are video tapes. For this study, three video tapes dealing with the basic concepts of aeronautics and astronautics were developed under the design model. Twenty activities were programmed in approximately 165 minutes of viewer time. A self instructional lesson guide listing the activity objective, the materials needed, any further proposed activities, and related readings was developed for each activity. The video tape scripts and lesson guides were reviewed before taping by professional television production personnel. The tapes were then produced and reviewed by a group of professional educators. A sample script is attached in Appendix A and sample lesson guides are attached in Appendix B.

Description of the Validation Population

The participants in this study were Space Science Education Specialists under contract to the National Aeronautics and Space Administration's Space Science Education Project.

The Space Science Education Specialist must meet specific criteria to qualify for employment in the project. Generally, he must have a bachelor's degree and five years of teaching experience with an emphasis in science or mathematics or a master's degree and three years of teaching experience. In addition to these minimum requirements, a preservice training course in aerospace education and continuous in-service education on NASA programs and related aerospace concepts is participated in by each Space Science Educational Specialist.

The Space Science Education Specialists are all quite possibly within the population the video tapes were designed for due to their ongoing involvement with both elementary and secondary education. However, the general nature of the study was explained to the specialists and only those who were interested in activities for elementary teachers were asked to participate. Twenty of the specialists viewed the tapes and completed the questionnaire. This represents 72 percent of the total number of specialists and is assumed to be 100 percent of those specialists interested in elementary education.

One additional research question which could be attacked only by utilizing this particular group, was one concerning the content validity of the video tapes. This is a question which has seldom been asked in the history of educational television. Komoski (24) has reported that "...only three of the 223 materials used in over 85% of broadcast television instruction have been learner tested." Gordon (15) reinforces this statement and goes on to propose guidelines for validating instructional television programs. This factor, the ability of the Space Science Education Specialists to validate the content coupled with the voluntary status of the participants was the reason for selecting this particular population for the validation study.

Collection of Data

Construction of the Opinionnaire

The opinionnaire was the source of data utilized to assess opinions toward teacher centered inservice utilizing closed circuit instructional units. The process of developing an adequate opinionnaire included the compiling of a preliminary set of questions based upon previous workshop experiences with inservice teachers. This was accomplished by reviewing descriptive evaluations of CCTV workshops conducted by personnel of the Educational Support Systems Center at Stillwater, Oklahoma during 1971.

The opinionnaire was then reviewed by individual consultation with doctoral students in education, the chairman of the writer's doctoral committee and Dr. Larry A. Thomas, Director of Evaluation for the Educational Support Systems Center ESEA Title III Project, "Improving Instruction Through Closed Circuit Television." The suggestions of these persons were incorporated into a final trial instrument which was administered to eight inservice teachers. The instrument was evaluated in terms of their responses and comments and placed in its final form by consultation with Dr. Thomas.

Design of the Opinionnaire

The opinionnaire was composed of fourteen items to which the Space Science Specialists responded on a Likert type scale that ranged from strongly agree to strongly disagree. The first thirteen items were designed to measure attitudes toward the concept of teacher centered inservice education utilizing self instructional CCTV units.

Question fourteen asked for an opinion on the content of the video tapes.

Question fifteen was a request for comments on the series of activities or their use which could be incorporated in improving their effect. This is possible due to the iterative feature of the design system. The video tapes, supportive materials, and the system itself are all subject to modification in response to generated feedback. A copy of the questionnaire is found in Appendix C.

Submission of Opinionnaire to Specialists

The Space Science Education Specialists viewed selected activity segments from all three video tapes during their annual conference held

September 5 to September 15, 1972 at Manned Spacecraft Center, Clear Lake City, Texas. The specialists viewed the tapes in groups ranging in size from three to seven and then attempted the exercises as demonstrated on the video tape. Finally, they completed the opinionnaire. A total of twenty specialists viewed at least three segments, one from each major topic area.

CHAPTER V

RESULTS OF THE STUDY

The first four chapters have contained a general introduction to the study, a review of pertinent literature, a detailed description of the theoretical design model, and a discussion of the validation procedures for the proposed model.

This chapter presents the results of the application of the design model, the reaction of the validation group to the video tapes produced under the model, and the findings from the opinionnaire.

The data obtained from the observed behavior and the responses to the opinionnaire will be presented and discussed in relation to the research questions posed in Chapter I. These data are presented in terms of percentage of participant response to items on the opinionnaire as they relate to particular research questions.

The design model is discussed in terms of its operation in producing the video tapes and data from the opinionnaire is presented to establish the content validity of the subject matter contained in the video tapes.

Research Question Number One

1. Can a design model be developed which will produce video tapes based on expressed needs of inservice elementary teachers?

The data to support a response to this question consist of the video tapes and supportive materials developed under the model.

In historical order, the following steps were implemented to produce the video tapes.

A. Helton's survey of aerospace workshops was utilized to identify a population of teachers and assess their needs in aerospace education.

B. Production meetings were held with the ESSC production personnel to decide the feasibility of mediating the proposed activities on video tape.

C. Terminal objectives were written for the thirty behaviors selected as candidates.

D. A draft script was produced for each activity.

E. Each draft script was reviewed with the ESSC director in terms of production constraints.

F. A decision was made concerning each activity in view of the expressed constraints and twenty activities were selected as acceptable.

G. Twenty working scripts were developed along with a self instructional learning guide for each unit. A sample script is attached in Appendix A and the instructional learning guides are attached in Appendix B.

H. The twenty activity oriented video tapes were produced at the ESSC Region 5 studio and reviewed for technical quality by the production staff.

There were no circumstances not anticipated in the theoretical design model. The two decision points in the design model were used to option out the various candidate activities which were not used. Some activities such as the construction of a model rocket were rejected at the first decision point due to the inability of the television medium to clearly display a step by step process with the intricacy inherent in constructing a small model. Other activities although qualifying for mediation by instructional television were rejected on the basis of cost, lack of outdoor filming capability, and other operational constraints.

Since the needs of the identified teachers were explicitly described by Helton and these needs were utilized to generate the terminal behaviors which governed the development of the video tapes and no unforeseen circumstances were incurred, the existence of the video tapes and supportive learning guides answer this question in the affirmative.

Research Question Number Two

2. Will the video tapes produced under this design model produce observeable viewer behavior change?

The data to support a response to this question were gathered immediately following each of the viewing sessions by the validating population. The materials for one or more of the viewed activites were made available and the Space Science Education Specialists were asked to attempt any of the activities they desired. All twenty activities were not attempted. However over half of them were attempted and completed successfully. More importantly, no one who elected to attempt an activity could not complete it. Stop action and instant replay were often implemented to clarify skills and concepts and in all cases, the viewing group fully controlled the information flow of the CCTV system.

Based upon these data, research question two is answered in the affirmative.

Research Question Number Three

3. Will inservice teachers respond favorably to the concept of instructional television units as a basis for teacher centered inservice education?

The data to support a response to this question were gathered from the opinionnaire completed by each of the viewers. Although the responses were tabulated on a five point strongly agree to strongly disagree continuum, the categorizes were collapsed to obtain only a measurement of agreement or disagreement. The neutral category was utilized only for responses in which the viewer had no opinion. If the item was not clearly understood, clarifying information was furnished until an opinion could be expressed.

Opinionnaire questions one and two dealt with the operation of the CCTV equipment. Ninety percent of the viewers felt that workshop participants would be capable of operating the VTR while ten percent of the viewers expressed neutral opinions.

Ninety percent of the viewers responded that stopping or replaying any sequency for further study was an advantage of the CCTV approach to inservice. Ten percent of the viewers expressed neutral opinions.

Question Three was designed to gather data concerning the viewers' opinion of video taped inservice as opposed to face to face instruction. Sixty-five percent of the viewers stated that teachers could learn as much from a properly constructed activity oriented video tape as they could from a live presentation. Twenty percent of the viewers held neutral opinions while fifteen percent held negative opinions.

TABLE I

PARTICIPANT RESPONSE TO THE STATEMENT: AFTER A SHORT TRAINING SESSION, WORKSHOP PARTICIPANTS WILL BE CAPABLE OF OPERATING THE VTR

Participants	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Raw Data	7	11	2	0	0
Percentage	35%	55%	10%	0%	0%

Percent of Agreement 90%
Percent of Disagreement 0%

TABLE II

PARTICIPANT RESPONSE TO THE STATEMENT: A BIG ADVANTAGE OF THE VIDEO TAPE APPROACH IS THAT ANY PORTION MAY BE STOPPED OR REPLAYED FOR FURTHER STUDY

Participants	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Raw Data	15	3	2	0	0
Percentage	75%	15%	10%	0%	0%

Percent of Agreement 90%
Percent of Disagreement 0%

Questions four, five, six, and seven were constructed to gather data concerning the performance of the activities demonstrated in the video tapes. Eighty percent of the viewers felt the activities should be done immediately after viewing the tape while twenty percent were neutral.

TABLE III

PARTICIPANT RESPONSE TO THE STATEMENT: TEACHERS CAN LEARN AS MUCH FROM A PROPERLY CONSTRUCTED VIDEO TAPE WHICH IS ACTIVITY ORIENTED AS THEY CAN FROM A LIVE PRESENTATION

Participants	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Raw Data	0	13	4	3	0
Percentage	0%	65%	20%	15%	0%

Percent of Agreement 65%
Percent of Disagreement 15%

TABLE IV

PARTICIPANT RESPONSE TO THE STATEMENT: THE ACTIVITIES OF A PARTICULAR PROGRAM SHOULD BE DONE IMMEDIATELY AFTER VIEWING THE TAPE

Participants	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Raw Data	8	8	4	0	0
Percentage	40%	40%	20%	0%	0%

Percent of Agreement 80%
Percent of Disagreement 0%

Seventy percent felt the activities should be done on a voluntary basis while fifteen percent held neutral opinions and fifteen percent were negative.

TABLE V

PARTICIPANT RESPONSE TO THE STATEMENT: THE ACTIVITIES SHOULD BE UNDERTAKEN ON A STRICTLY VOLUNTARY BASIS

Participants	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Raw Data	4	10	3	3	0
Percentage	20%	50%	15%	15%	0%

Percent of Agreement 70%
Percent of Disagreement 15%

Eighty percent of the viewers felt it was necessary to do the acitivity before attempting it in a live classroom situation while fifteen percent held neutral opinions and five percent responded in the negative.

Sixty percent of the viewers felt that it would not be difficult to do the activities if the required materials were not provided with the video tapes. Ten percent expressed neutral opinions while thirty percent of the viewers agreed that it would be difficult without the materials.

TABLE VI

PARTICIPANT RESPONSE TO THE STATEMENT: IT IS NECESSARY THAT ONE DO THE ACTIVITY BEFORE ATTEMPTING IT IN A LIVE CLASSROOM SITUATION

Participants	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Raw Data	9	7	3	1	0
Percentage	45%	35%	15%	5%	0%

Percent of Agreement 80%
Percent of Disagreement 5%

TABLE VII

PARTICIPANT RESPONSE TO THE STATEMENT: IT WOULD BE DIFFICULT TO DO THE ACTIVITY IF THE REQUIRED MATERIALS ARE NOT PROVIDED ALONG WITH THE VIDEO TAPES

Participants	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Raw Data	0	6	2	7	5
Percentage	0%	30%	10%	35%	25%

Percent of Agreement 30%
Percent of Disagreement 60%

Questions eight, twelve, and thirteen dealt with opinions concerning the concept of non-structured, teacher centered inservice education.

One hundred percent of the viewers expressed the opinion that they would like to participate in a non-structured workshop with teacher centered features.

TABLE VIII

PARTICIPANTS RESPONSE TO THE STATEMENT: I WOULD LIKE TO PARTICIPATE IN A NON-STRUCTURED TEACHER-CENTERED WORKSHOP UTILIZING MATERIALS SUCH AS THESE: VIDEO TAPES, ETC.

Participants	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Raw Data	9	11	0	0	0
Percentage	45%	55%	0%	0%	0%

Percent of Agreement 100%
Percent of Disagreement 0%

Eighty percent expressed the opinion that in general the concept was "great" while twenty percent were neutral.

Forty-five percent of the viewers felt that a coordinator was not necessary for the effective implementation of a CCTV teacher centered workshop. Fifteen percent held neutral opinions while forty percent responded negatively.

Questions nine, ten, and eleven were concerned with the viewer opinions concerning requirements, location, and organization of a CCTV teacher centered inservice program.

Seventy percent of the viewers felt that performing the activities and preparing a teaching unit were sufficient for receiving a pass grade in the inservice workshop. Thirty percent expressed a neutral opinion.

TABLE IX

PARTICIPANT RESPONSE TO THE STATEMENT: GENERALLY, THE IDEA OF NON-STRUCTURED TEACHER-CENTERED WORKSHOPS IS GREAT

Participants	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Raw Data	7	9	4	0	0
Percentage	35%	45%	20%	0%	0%

Percent of Agreement 80%
Percent of Disagreement 0%

TABLE X

PARTICIPANT RESPONSE TO THE STATEMENT: NON-STRUCTURED, TEACHER-CENTERED WORKSHOPS CAN BE EFFECTIVE USING ONLY THE VIDEO TAPES AND SUPPORTIVE MATERIALS. IN OTHER WORDS, A WORKSHOP COORDINATOR IS NOT NECESSARILY NEEDED IF THE TAPES AND MATERIALS ARE AVAILABLE

Participants	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Raw Data	4	5	3	6	2
Percentage	20%	25%	15%	30%	10%

Percent of Agreement 45%
Percent of Disagreement 40%

TABLE XI

PARTICIPANT RESPONSE TO THE STATEMENT: DOING THE VIDEO TAPED ACTIVITIES AND PREPARING A TEACHING UNIT WOULD BE ENOUGH REQUIREMENT FOR A PASS GRADE IN AN INSERVICE PROGRAM

Participants	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Raw Data	8	6	6	0	0
Percentage	40%	30%	30%	0%	0%

Percent of Agreement 70%
Percent of Disagreement 0%

Eighty percent of the respondents expressed the opinion that teachers would prefer CCTV teacher centered inservice in their school to commuting to inservice activities. Fifteen percent held neutral opinions while five percent replied in the negative.

TABLE XII

PARTICIPANT RESPONSE TO THE STATEMENT: I FEEL TEACHERS WOULD PREFER TAKING A VIDEO TAPE INSERVICE PROGRAM AT THEIR SCHOOL TO COMMUTING TO A CENTRAL POINT FOR CLASSES

Participants	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Raw Date	7	9	3	1	0
Percentage	35%	45%	15%	5%	0%

Percent of Agreement 80%
Percent of Disagreement 5%

Ninety percent of the viewers stated that activity oriented video tapes would be effective for inservice courses. Ten percent expressed neutral opinions.

TABLE XIII

PARTICIPANT RESPONSE TO THE STATEMENT: VIDEO TAPES, USING AN ACTIVITY FORMAT, ON TOPICS REQUESTED BY INSERVICE TEACHERS WOULD BE EFFECTIVE FOR INSERVICE COURSES

Participants	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Raw Data	9	9	2	0	0
Percentage	45%	45%	10%	0%	0%

Percent of Agreement 90%
Percent of Disagreement 0%

Possibly the most important statistic presented here in terms of establishing the overall opinion of the viewers toward teacher centered inservice is evident in the negative responses to items which would affect the operation of CCTV teacher centered inservice.

None of the viewers responded negatively concerning the operation or features of the CCTV equipment.

Fifteen percent of the viewers favored live presentations over video taped activities.

None of the viewers responded negatively to participating in CCTV activity oriented workshops.

None of the viewers felt that activities on video tape would not be effective for inservice courses.

None of the viewers expressed a negative opinion to the description of the concept of CCTV teacher centered inservice as "great".

Five percent of the viewers expressed the opinion that teachers would rather commute to a central location than utilize CCTV teacher centered inservice.

None of the viewers disagree with the format of doing the activities and preparing a teaching unit in order to receive a pass grade.

The extremely small amount of negative responses to these items, questions 1,2,3,8,9,10,11, and 12 coupled with the strong positive responses to the same questions appear to support a positive response to research question number three.

Research Question Number Four

4. Will the validation population of aerospace education experts consider the content of the video tapes as adequate?

The data for answering this question are derived from responses to opinionnaire questions fourteen and fifteen.

Eighty-five percent of the viewers agreed that the content of the series was excellent. Fifteen percent of the respondents expressed neutral opinions.

Three respondents constituted the neutral group on question fourteen. On question fifteen, two of these respondents stated they were unable to form an opinion because the concept was new to them. The other respondent stated he would have to watch each and every activity before he could respond positively.

TABLE XIV

PARTICIPANT RESPONSE TO THE STATEMENT: THE CONTENT OF THIS SERIES IS EXCELLENT

Participants	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Raw Data	8	9	3	0	0
Percentage	40%	45%	15%	0%	0%

Percent of Agreement 85%
Percent of Disagreement 0%

Based upon the lack of negative response and the high percentage of positive response, research question four apparently is answered in the positive.

Additional Findings

Opinionnaire questions seven and thirteen when coupled with the feedback from the open ended question fifteen point out some interesting facts for operationalizing CCTV teacher centered inservice.

Questions seven and thirteen were the only ones which were not answered strongly in the affirmative. When the answers are inspected in relation to comments added in question fifteen it becomes apparent that the large majority of the viewers felt that although it would not be necessary to package materials for the activities to accompany the video tapes, an on site coordinator would be necessary to gather these materials and make other arrangements before CCTV teacher centered in-service could be implemented.

CHAPTER VI

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The principal goal of this study was to produce a systems approach for developing instructional video units. A review of the literature disclosed that very few researchers had considered this matter. Indeed, most instructional television research had been focused on the product of television production as opposed to the requirements of any particular educational need. To try to attack this situation, the theoretical considerations developed at Marshall Space Flight Center's Central Systems Engineering Division by John Aberg were borrowed and adapted to the particular task of developing inservice activity programs in aerospace education for elementary teachers.

Each component of the theoretical design system was conceived, tested, and operationalized in a series of pilot studies. The components were then integrated into subsystems and the first application of the total system was in the production of twenty video tapes demonstrating aerospace activities for elementary teachers professing a need for them.

Twenty Space Science Education Specialists of NASA's Space Science Education Project expressed a need for the activities in the video tapes. These educators viewed the tapes, attempted the activities and responded to an opinionnaire.

Conclusions

Four research questions were posed. The first dealt with the principal goal of developing a design model for producing instructional video tapes based upon inservice teachers needs. A survey of the historical record of the development of the design model, a review of the pilot studies, and the successful production of the activity based video tapes provided the data to conclude that the design model had been successfully developed.

The second research question was concerned with whether the inservice teacher could perform the activities presented on the video tapes. The educators in the validation population attempted all of the activities they viewed and successfully completed all of them. This data led to the conclusion that the video tapes could effect the observeable behaviors they were designed to produce.

The third research question dealt with whether the inservice teachers would respond favorably to experiences based upon the video tapes. To measure the inservice educator's opinions, an instrument was developed and administered. Although no statistical significance can be applied to the results, an analysis of the key questions where definite negative opinions toward the concept were elicited, showed almost a complete lack of negative opinion. In addition, the high percentage of positive responses toward the utilization of CCTV teacher centered inservice coupled with the open ended comments of the respondents, led to the conclusion that the concept had been favorably received.

The fourth research question was concerned with the content of the video tapes. None of the respondents, who were experts in this curricular area, responded negatively to the statement that the content was excellent. The great majority of the experts rated the content excellent thus supporting a positive response to the research question.

Recommendations

This study was exploratory in nature and the data collected in conjunction with it have limited significance. However, the data does furnish a basis for the further study of CCTV teacher centered inservice education.

It is recommended that the design model be used to generate inservice video tapes in a number of teacher designated areas. This would furnish the future researcher with a variety of treatments to utilize as stimulus variables, provide further operational iteration of the design model, and produce a useful data bank of teacher identified supportive materials.

It is recommended that a study be conducted utilizing a pre-test and post-test design to measure the change in attitude toward the concept of CCTV teacher centered inservice education as defined in this study.

Finally, it is recommended that the suggestions of the Space Science Education Specialists be implemented concerning the further development of training materials for on site supervisors of CCTV teacher centered inservice.

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APPENDIX A

Activities in Aeronautics for Elementary Teachers

SCRIPT

1. SHOW VIDEO TAPE	INTRODUCTION ABOUT VIDEO INSTRUCTIONAL UNITS.
2. SHOW VTR	
3. THREAD, PLAY REWIND, STOP	TODAY WE ARE GOING TO SHARE WITH YOU SOME ACTIVITIES WHICH ELEMENTARY TEACHERS HAVE DEVELOPED AND SHARED WITH US. MANY OF THE
SHOW AECG	ACTIVITIES ARE DESCRIBED IN THE: AEROSPACE EDUCATION CURRICULUM GUIDE (K - 12). IF YOU DO NOT HAVE A COPY OF THIS GUIDE YOU MAY OBTAIN ONE FROM:
SUPER ADDRESS	OKLAHOMA AERONAUTICS COMMISSION 424 UNITED FUND FOUNDERS TOWER BUILDING OKLAHOMA CITY, OKLAHOMA 73112
	THE AEROSPACE EDUCATION CURRICULUM GUIDE BEGINS ITS ELEMENTARY LEVEL PROGRAM WITH A STUDY OF AIR AND ITS PROPERTIES. HERE ARE SEVERAL ACTIVITIES OF VARYING COMPLEXITY THAT WILL HELP YOU TEACH THE CONCEPT OF AIR CONCRETELY.

DEMONSTRATE ITS PROPERTIES:

OBJECTIVE ONE:

DRUM OR SUPER

DEMONSTRATE THAT AIR IS PRESENT IN THE CLASSROOM AND ALL OF OUR EARTH ENVIRONMENT.

ON PAGE THREE IN THE GUIDE, TWELVE ACTIVITIES IN THIS AREA ARE LISTED TO HELP YOU UNDERSTAND THEM BETTER, WE WILL DEMONSTRATE SOME OF THEM AND OTHERS FOR YOU.

SUPER
ACTIVITY ONE
FEELING AIR

ACTIVITY ONE:

HERE IS AN ORDINARY FAN. YOU CAN USE IT TO DEMONSTRATE THE EXISTENCE OF AIR.

1. ATTACH A PAPER STREAMER WITH TAPE
2. SWITCH ON THE FAN
3. OBSERVE THE RESULTS

THIS TEACHES THAT ALTHOUGH AIR IS INVISIBLE, ITS MOVEMENT CAN BE FELT AND WE CALL THIS MOVEMENT IN NATURE, WIND.

IF YOU HAVE A LARGE CONTAINER SUCH AS AN AQUARIUM, YOU CAN ACTUALLY SEE AIR AGAINST THE BACK GROUND OF WATER.

SUPER ACTIVITY TWO

SEEING AIR IN WATER

1. TRAP AIR IN A GLASS.
2. HOLD A WATER FILLED GLASS ABOVE IT.
3. SEE THE AIR AS YOU POUR IT BACK AND FORTH IN THE GLASSES.

SUPER ACTIVITY THREE

AIR TAKES UP SPACE

AIR TAKES UP SPACE. A SIMPLE WAY TO DEMONSTRATE THIS IS JUST BY BLOWING UP A BALLOON. NOW SOME SHARP KID MAY POINT OUT THAT YOUR EXHALED BREATH IS NOT REALLY AIR BUT THAT'S GREAT. JUST STOP AND DISCUSS AIR, BREATH, AND ANY OTHER GASES THE STUDENTS KNOW ABOUT. YOU ARE REALLY DEMONSTRATING PROPERTIES OF GASES.

1. BLOW UP THE BALLOON.
2. SQUEEZE IT AROUND.
3. FEEL THE AIR COMING OUT.
4. LET THE KIDS FOOL AROUND WITH SOME BALLOONS.

5. ALSO USE PAPER BAGS, PLASTIC BAGS, AND SOAP BUBBLES.

OKAY IF YOU WANT TO GENERALIZE THIS LAST EXPERIENCE, BORROW AN AIR PUMP FROM THE COACH AND INFLATE SOME FOOTBALLS, BASKETBALLS, VOLLEYBALLS, AND KICKBALLS. EXPLAIN THAT THE AIR GUAGE SHOWS HOW MUCH AIR YOU ARE PUTTING IN THE BALL.

SUPER ACTIVITY FOUR

AIR HAS WEIGHT

TO DEMONSTRATE THE VERY IMPORTANT CONCEPT THAT AIR HAS WEIGHT, YOU WILL NEED TO MAKE A BALANCE SCALE. YOU MAY NEED TO DEMONSTRATE THE CONCEPT THAT EQUAL WEIGHTS PLACED AT EQUAL DISTANCES WILL BALANCE THE BEAM. REMIND THE KIDS ABOUT HOW A TEETER - TOTTER WORKS. IT'S THE SAME PRINCIPLE.

1. INFLATE TWO BALLOONS TO THE SAME SIZE.

2. BALANCE THE BALLOONS ON THE BEAM.

3. BREAK ONE WITH A PIN.

4. OBSERVE WHICH ONE DROPS.

IF YOU NEED TO GENERALIZE THIS EXPERIENCE, TAKE SOME OF THE BALLS YOU USED IN ACTIVITY ONE AND DEFLATE THEM. WEIGH THEM ON AN ACCURATE SCALE. THEN INFLATE THEM. THE BALLS WILL WEIGH MORE.

OKAY, WE HAVE LOOKED AT THESE PROPERTIES OF AIR.

PC
AIR PROPERTIES

1. AIR IS INVISIBLE
2. AIR OCCUPIES SPACE
3. AIR CAN BE FELT
4. AIR HAS WEIGHT
5. AIR EXERTS PRESSURE

THERE ARE OTHER PROPERTIES OF AIR BUT THESE ARE ENOUGH TO GET YOU STARTED IN SOME ACTIVITIES ASSOCIATED WITH FLIGHT.

SUPER ACTIVITY FOUR

THE PARACHUTE

ALL OBJECTS WITHIN THE ATMOSPHERE TRY TO FALL TO EARTH. LUCKILY, THE PRESSURE PROPERTY OF AIR CAN BE USED TO SLOW US DOWN. MANY A PILOT HAS BEEN SAVED BY HIS PARACHUTE. THEY ARE EASY TO MAKE AND EASY TO DEMONSTRATE.

1. TAKE SOME FILM PLASTIC
2. CUT IT WITH A PATTERN INTO A HEXAGON
3. CUT UP A GUMMED LABEL
4. ATTACH STRING TO THE CORNERS WITH THE PIECES
5. TIE THE STRINGS TOGETHER AND TRIM
6. ATTACH A SMALL WEIGHT
7. DROP FROM THE ROOF, MONKEY BARS, SLIDE TOP,
8. OR FOLD NEATLY AND THROW IT UP.

SUPER ACTIVITY SIX

THE KITE

KITES FLY DUE TO AIR PRESSURE. NOW YOU CAN BUILD A KITE BUT YOU MAY JUST WANT TO BUY ONE OF THE MANY EXCELLENT COMMERCIAL KITS AVAILABLE.

1. DIVIDE THE CLASS INTO SMALL GROUPS

2. ASSEMBLE THE KITES

3. HAVE A PREFLIGHT MEETING ON FLIGHT PROCEDURES

4. GO OUT AND FLY A KITE.

SUPER ACTIVITY SEVEN

LIGHTER THAN AIR BALLOONS

THIS IS OUR LAST ACTIVITY ASSOCIATED WITH THE BASIC PROPERTIES OF AIR. YOU WILL FIND IT A MUST AS A FUN LEARNING ACTIVITY.

REMEMBER WHEN WE TALKED ABOUT AIR AS BEING JUST ONE OF MANY GASES? WELL, AERONAUTS AND SCIENTISTS HAVE USED THE WEIGHT PROPERTY OF AIR TO FLY AND CONDUCT SCIENTIFIC STUDIES FOR MANY YEARS.

THERE IS ONE GAS THAT IS LIGHTER THAN AIR THAT IS CALLED HELIUM. HOW DO YOU FIND IT?

PC

HELIUM SOURCES

WELL TRY THESE SOURCES:

1. HIGH SCHOOL CHEMISTRY TEACHER

2. WELDING SUPPLY COMPANY

3. COLLEGE CHEMISTRY DEPARTMENT

I AM SURE SOMEONE WILL FILL ONE OR TWO BALLOONS FOR YOU. SCIENTISTS USE LIGHTER THAN AIR BALLOONS TO STUDY WIND AND OTHER ATMOSPHERIC PROPERTIES. THAT'S WHAT WE'RE GOING TO DO TODAY.

1. OBTAIN A POST CARD
2. RECORD PERTINENT INFORMATION
3. SEAL THE CARD IN A BAGGY
4. INFLATE A BALLOON WITH HELIUM
5. TIE THE CARD TO THE BALLOON
6. LAUNCH UNDER PROPER CONDITIONS.

OKAY, THIS IS A CONVENIENT PLACE TO STOP. THE MATERIALS ARE PRESENT FOR YOU TO TRY THESE ACTIVITIES. PLEASE DO THEM ALL. IF YOU HAVE PROBLEMS, REVIEW THE ACTIVITY ON THE VIDEO TAPE.

GOOD LUCK.

APPENDIX B

Aerospace Activities for Elementary Teachers

Video Tape One Counter Setting 000

Introduction

The three one hour video tapes in this video instructional unit contain twenty activities which teachers can do with their students. The lesson guides include materials, suggestions, and references.

Bibliography:

The following publications are utilized in the references accompanying each unit.

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Aerospace Activities for Elementary Teachers

Video Tape One   Counter Setting 083

Activity One - Feeling Air

Objective:

The viewer will be able to demonstrate an activity which involves feeling air.

Materials Needed:

1. Fan
2. Paper streamers
3. Tape

Further Suggestions:

The basic activity was explained in the video tape. However, different lengths, materials, and fan speeds will give different results. Experiment a little.

References:

This activity and related ones are found in Demonstration Aids for Aviation Education, pp. 1-9. Aerospace Education Curriculum Guide (K-12), pp. 2-4.

Aerospace Activities for Elementary Teachers

Video Tape One Counter Setting 146

Activity Two - Seeing Air in Water

Objective:

The viewer will be able to demonstrate an activity which involves seeing air under water.

Materials Needed:

1. Aquarium or tub
2. Clear water glasses
3. Paper

Further Suggestions:

You can place blotter paper in the bottom of the glass and the air bubble will keep it from getting wet. Many air properties, demonstr-tions, and activities are listed in the references.

References:

This acitivity and related ones are found in Demonstration Aids for Aviation Education, Chapter One, pp. 1-9. An Introduction to Aerospace Education, pp. 54-55. Introducing Children to Space, The Lincoln Plan. Aerospace Education Curriculum Guide (K-12), pp. 2-4.

Aerospace Activities for Elementary Teachers

Video Tape One Counter Setting 206

Activity Three - Air Takes Up Space

Objective:

The viewer will be able to demonstrate in a concrete experiment that air takes up space.

Materials Needed:

1. Large balloons
2. Paper sack
3. Soap and bubble generator
4. Plastic bags

Further Suggestions:

It's fun to blow up objects with gases. Very young children don't really differentiate other gases from air. Later you'll do an experiment to help them see the differences, Be sure and generate some soap bubbles, they're fascinating.

References:

Demonstration Aids for Aviation Education, pp. 1-3. Aerospace Education Curriculum Guide (K-12), pp. 2-4.

Aerospace Activities for Elementary Teachers

Video Tape One Counter Setting 290

Activity Four - Air Has Weight

Objective:

The viewer will be able to demonstrate an experiment which proves air has weight.

Materials Needed:

1. Football
2. Basketball
3. Scale (graduated in ounces)
4. Large balloons
5. String
6. Tape
7. Pin
8. Dowel

Further Suggestions:

Air weighs .08 pounds per cubic foot. It is a very interesting group activity to measure the room and calculate the weight of the air in the room. It has also been said that we carry the weight of two or three elephants around on our shoulders. This is easy to compute. We are about one square foot in surface area across the shoulders. Now assume we have 50 miles of air above us. How many cubic feet of air is pressing on our heads and shoulders? How much does this air weigh?

References:

This acitvity and related ones are found in Demonstration Aids for Aerospace Education, Chapter One, pp. 1-9. Aerospace Education Curriculum Guide (K-12), pp. 2-4.

Aerospace Acitivites for Elementary Teachers

Video Tape One Counter Setting 470

Activity Five - The Parachute

Objective:

The viewer will be able to construct a parachute and demonstrate its behavior.

Materials Needed:

1. Film plastic (cleaning bags)
2. Gummed labels
3. String
4. Washer or small weight
5. Scissors
6. Template (hexagon)
7. Knife

Further Suggestions:

The parachutes may be dropped from different heights. Pupils may want to time their rate of descent with a stop watch. It is interesting to drop a washer without a parachute at the same time you drop the parachute with the washer and compare the fall times. Finally it is fruitful to experiment with other shapes of parachutes, with other size parachutes, and even with parachutes with holes punched in them.

References:

This activity and related ones are found in Demonstration Aids for Aviation Education, Chapter One, pp. 1-9. Aerospace Education Curriculum Guide (K-12), p. 15.

Aerospace Activities for Elementary Teachers

Video Tape One Counter Setting 540

Activity Six -- The Kite

Objective:

The viewer will be able to construct and fly a kite.

Materials Needed:

1. Several kite kits
2. Kite string
3. Cotton rags

Further Suggestions:

The commercial kits normally have directions for both building and flying. If there is a great deal of wind, tail material should be added. Shred some old shirts and use as little tail as possible to gain stability. If you have some willing kids, then get some light lath strips or one quarter inch dowel and build a kite of your own design. A very good one is shown in the references.

References:

The "Scott Sled" kite design is shown and discussed in An Introduction to Aerospace Education, pp. 254-255. Other kite designs are listed in library books on the topic. Demonstration Aids for Aviation, pp. 1-9.

Aerospace Activities for Elementary Teachers

Video Tape One   Counter Setting 610

Activity Seven - Lighter Than Air Balloons

Objective:

The viewer will be able to launch a lighter than air balloon.

Materials Needed:

1. Helium sources
2. Large balloons
3. Baggies
4. String
5. Tape
6. Postcard - with stamp
7. Pen with waterproof ink

Further Suggestions:

Do not launch when winds are active. Try to launch on days when they are less than five miles per hour. Don't give up if your first postcard doesn't come back. Try launching at least one per month during the school year. Also, if you have a weather research unit at a college or airport near you, try to get your class on a field trip to see one of these large balloons. For some fun, place a helium filled balloon on the ceiling of your classroom. The children will be amazed when it sinks to the floor after several hours even though it still appears to be full. However, it's not full of helium, air has displaced it!

References:

Hot air balloons are described in An Introduction to Aerospace Education on pp. 252-254. A template which may be scaled up or down is shown and construction procedures are shown. Be sure and read the safety precautions for generating the hot air to fill the balloon. The nine foot balloon described will ascend for several hundred feet. If you just want a static model of a hot air balloon, use brown wrapping paper instead of tissue and the balloon will stand by itself. Introducing Children to Space, The Lincoln Plan, pp. 54-55.

Aerospace Activities for Elementary Teachers

Video Tape Two   Counter Setting 000

Activity One - Lift

Objective:

The viewer will be able to demonstrate the phenomenon termed "lift."

Materials Needed:

1. Typing paper
2. Drawing of wing cross section
3. 4" x 6" file card

Further Suggestions:

None

References:

Other dramatic demonstrations of lift are found in Demonstration Aids for Aviation Education, pp. 11-12. An Introduction to Aerospace Education, pp. 74-77 contains some useful definitions, and activities involving lift.

Aerospace Activities for Elementary Teachers

Video Tape Two Counter Setting 174

Activity Two - The Parts of the Airplane

Objective:

The viewer will be able to demonstrate techniques for mounting pictures, enlarging pictures, and assembling a collage.

Materials Needed:

1. Spray glue
2. Assorted pictures
3. Aircraft nomenclature diagram
4. Scissors
5. Rub on type
6. Felt pens
7. Poster board

Further Suggestions:

Come on! At least mount your nomenclature diagram and try a collage or mounting a print. You can use them for years. Another aid for learning the parts of the airplane is to assemble a tag board or cardboard model with moveable parts.

References:

An Introduction to Aerospace Education, pp. 74-77. Aerospace Education Curriculum Guide (K-12), pp. 19-23. Demonstration Aids for Aviation Education, Prologue.

Aerospace Activities for Elementary Teachers

Video Tape Two   Counter Setting 400

Activity Three - Constructing Paper Airplanes

Objective:

The participant will be able to construct a distance and an aerobatic paper airplane, fly these aircraft, and conduct a paper airplane contest.

Materials Needed:

1. Several sheets of typing paper
2. Paper clips
3. Scotch tape
4. Scissors or knife

Further Suggestions:

For your convenience, we have furnished two marked sheets of paper which will fold into paper airplanes. You may need to rerun or freeze the tape on this one, but you'll get the hang of it.

To Run A Contest:

1. Let the kids have a day or two of "messing around" or experiment time.
2. Then make up the rules. The only requirements should be the performance of the paper aircraft.
3. First Event: Straight and level flying. Place a six or eight foot table upside down on another table or make you some stick "goalposts" for your target. Each contestant should get two tries from a line about ten yards away. Any plane passing through the goal area qualifies.
4. Second Event: Aerobatics. Using the broad wing design or any other the pupil wishes, the criterion is to DO A MANEUVER AFTER PREDICTING IT. For example, a contestant should say, "my plane will loop the loop," and then in two tries, he should perform a loop. Rolls, loops, inverted flight, turns, almost any maneuver is acceptable if predicted.
5. The Flyoff: After eliminations on the first two events, the flyoff can be used for winners. You'll need something about as big as a gymnasium for this. Set up the goalposts and move your line back five yards each time until you have a winner.

References:

An Introduction to Aerospace Education, pp. 248-250. Demonstration

Aids for Aviation Education, p. 14. The Great International Paper Airplane Book. This is a fantastic book with many patterns and designs. How To Make and Fly Paper Airplanes. This inexpensive and excellent book was written by Capt. Barnaby, an aviation pioneer. It's inexpensive and available from Scholastic Books. Aerospace Education Curriculum Guide (K-12), p. 20.

Aerospace Activities for Elementary Teachers

Video Tape Two Counter Setting 590

Activity Four - Balsa and Foam Gliders

Objective:

The viewer will be able to construct and fly a balsa wood or foam glider.

Materials Needed:

1. Balsa wood glider
2. Styrofoam glider

Further Suggestions:

Foam and balsa gliders can also be used in aerobatic and distance contests. Also these gliders can be flown out of doors in light winds where paper airplanes cannot.

References:

Balsa wood gliders and powered craft are described on pages 250 and 251 in An Introduction to Aerospace Education. Aerospace Education Curriculum Guide, p. 20.

Aerospace Activities for Elementary Teachers

Video Tape Two Counter Setting 690

Activity Five - Propeller Aircraft

Objective:

The viewer will be able to fly propeller operated balsa wood aircraft.

Materials Needed:

1. Propeller driven model aircraft.

Further Suggestions:

Many commercial propeller driven aircraft come with wheels. This is an excellent opportunity to investigate the phenomena of take off and landing. In addition to this activity, you should put out feelers to locate gasoline power and radio control aircraft modelers in your area. Demonstrations can easily be held on a school playground with minimal safety precautions.

References:

An Introduction to Aerospace Education, pp. 250-251. Aerospace Education Curriculum Guide (K-12), pp. 22-23.

Aerospace Activities for Elementary Teachers

Video Tape Two Counter Setting 790

Activity Six - A Field Trip to the Airport

Objective:

The viewer will be able to schedule a field trip to the airport which will involve activities coordinated by the airport manager.

Materials Needed:

None

Further Suggestions:

A trip to the airport can be a great benefit for developing interest in your project. One follow up activity which we have found to be very useful, is a writing experience based upon the day's activities. To write one's own story based on one's perception of the day's activities is most fruitful. We have also had good response to creativity writing experiences based on topics generated by a visit to the airport.

References:

An Introduction to Aerospace Education, pp. 209-215 lists and describes procedures for aerospace oriented field trips. Aerospace Education Curriculum Guide (K-12), p. 22.

Aerospace Activities for Elementary Teachers

Video Tape Two Counter Setting 830

Activity Seven - The Cessna Kit

Objective:

The viewer will be able to order the Cessna Kit for elementary teachers.

Materials Needed:

1. The Cessna Kit

Further Suggestions:

You should mount the pictures furnished in the kit. This way you may use them indefinitely. Read the kit materials and use all of the aids. This is an excellent teaching unit.

References:

Aerospace Education Curriculum Guide (K-12). Aviation Educational Materials.

Aerospace Activities for Elementary Teachers

Video Tape Three   Counter Setting 000

Activity One - Solar System Models

Objective:

The viewer will be able to supervise the building of a solar system mobile.

Materials Needed:

1. Styrofoam balls
2. Nylon sewing thread
3. Map pins
4. Cotton
5. Poster paint
6. Five four foot lengths of one-quarter inch dowel
7. Pictures of the planets
8. Glue
9. Nails for weights
10. Paper

Further Suggestions:

This is a difficult activity requiring cooperation and coordination. That's why it's such a good one. Remember, you can rerun any portion of the tape you desire. If you get hung up just back up and look at the hard part again on the tape.

If you have very young children you may wish to go with the simpler solar system model on a line. This is a straightforward and easy activity without the physical complications of balancing out the support beams.

References:

"A Trip to the Planets", National Geographic. Most pictured encyclopedias have an excellent unit on the solar system. Aerospace Education Curriculum Guide (K-12), pp. 36-38. Introducing Children to Space, The Lincoln Plan, pp. 106-107. Space Resources for Teachers Space Science, pp. 84-103.

SOLAR SYSTEM OBJECT	DIAMETER (MILES)	DIST. FROM SUN (MILES)	DIAMETER (SCALE)	DISTANCE (SCALE)
SUN	865,000	0	279	0
MERCURY	3,100	36,000,000	1.0	.33
VENUS	7,700	67,250,000	2.5	.67
EARTH	7,918	93,000,000	2.5	1.0
MARS	4,220	141,700,000	1.2	1.5
ASTEROIDS	VARIES	VARIES		
JUPITER	88,700	484,000,000	28.6	5.0
SATURN	71,600	887,000,000	23.1	9.5
URANUS	32,000	1,787,000,000	10.3	19
NEPTUNE	31,000	2,797,000,000	10.0	30
PLUTO	3,600	3,675,000,000	1.1	40

Aerospace Activities for Elementary Teachers

Video Tape Three Counter Setting 289

Activity Two - Reaction Motors

Objective:

The viewer will be able to demonstrate the operation of a reaction motor.

Materials Needed:

1. Balloons
2. Styrofoam cups
3. Soda straws
4. Nylon line or thread
5. Magic mending tape

Further Suggestions:

Reaction motors are inherently dangerous. The balloon is by far the safest demonstration aide. Therefore, we recommend further investigation of reaction motors only with careful supervision by well qualified personnel. Check with high school or college instructors of science before attempting any activities with compressed gas or pyrotechnic reaction devices.

References:

An Introduction to Aerospace Education, pp. 89-92. Aerospace Education Curriculum Guide (K-12), pp. 24-28.

Aerospace Activities for Elementary Teachers

Video Tape Three   Counter Setting 387

Activity Three - Recycled Rockets

Objective:

The viewer will be able to construct a display rocket model from the materials given.

Materials Needed:

1. Plastic bottles
2. Plastic coffee cups
3. Paper cups
4. Epoxy cement
5. Paper
6. Scissors
7. Knife
8. Aluminum cans
9. NASA publications

Further Suggestions:

Now that you have the hang of "junk" modeling, try other rockets. The Titan, Saturns, Little Joe, Redstone and rockets of your own design are easy and inexpensive to contruct. Model spacecraft such as Gemini and Apollo are basic geometric shapes that can be duplicated and Skylab, the United State's first space station, can be constructed out of coffee cans or bleach bottles.

References:

An Introduction to Aerospace Education, p. 92. Introducing Children to Space, The Lincoln Plan, pp. 32-36. Aerospace Education Curriculum Guide, (K-12), pp. 24-28.

Aerospace Activities for Elementary Teachers

Video Tape Three Counter Setting 495

Activity Four - Model Rockets

Objective:

The viewer will be able to obtain, construct, and launch a model rocket.

Materials Needed:

1. Commercial model rocket kit
2. Estes Model Rocket Catalog
3. Aerospace Education and Model Rocketry
4. Space Age Technology

Further Suggestions:

Some things just cannot be shown well on television. Building a model rocket from a commercial kit is one of them. The plans in the commercial kits are excellent. They must be followed step by step. Possibly the best way to construct a model rocket correctly is to put out the word for an eleven year old rocketry fan to come to your aid. These kids are usually inspired and avid teachers.

If you decide to launch one or more rockets, recruit some high school or adult help. If you have a model rocket club in your area, solicit their assistance. In any case, stress safety. Model rocketry should be conducted as a school activity but it should be conducted properly.

References:

An Introduction to Aerospace Education, pp. 251-252. The booklets listed under Materials Needed are excellent references.

Aerospace Activities for Elementary Teachers

Video Tape Three Counter Setting 607

Activity Five - Protecting the Astronaut

Objective:

The viewer will be able to construct a craft capable of offering life support to an "egg" astronaut.

Materials Needed:

1. Cans
2. Boxes
3. Foam
4. Paper
5. Balloons
6. Kites
7. Parachutes
8. Model Rockets
9. Anything you can imagine

Further Suggestions:

There are many ways to conduct the test drop. I prefer to let the kids make the rules and work as teams or individuals. One way is to drop the package from a given height such as a room window or school roof. One group even hired an airplane and dropped the packages from it. No matter how you do it, you'll have fun.

References:

Aerospace Education Curriculum Guide (K-1-), pp. 42-49.

Aerospace Activities for Elementary Teachers

Video Tape Three   Counter Setting 678

Activity Six - Life in the Spacecraft

Objective:

The viewer will be able to construct a spacecraft, outfit it, and conduct living experiences inside of it.

Materials Needed:

1. Chairs
2. Wrapping paper
3. Staple gun
4. 8 - 1"x1"x6' wooden sticks
5. 8 - 1"x1"x2' wooden sticks
6. Tag board
7. Plastic
8. Cord or Wire
9. Paint and brust

Further Suggestions:

This activity can use lots of imagination. Leave the spacecraft up for a long time. It's a good quiet corner for individual reading. Rig up a listening post inside and you have a great creative and fantasy space. Build on to your spacecraft. Add lights, knobs, control panels, anything the kids want. Then have lots of reading materials around because they'll want to use them.

References:

An Introduction to Aerospace Education, p. 64. Introducing Children to Space, The Lincoln Plan, pp. 16-18. Aerospace Education Curriculum Guide (K-12), pp. 50-52.

APPENDIX C

OPINIONNAIRE

This instrument is designed to measure how you feel about inservice education and in particular "teacher centered" inservice education utilizing video taped presentations and accompanying activities. Please indicate your feelings by marking the response which indicates the degree with which you agree or disagree with each statement.

TABLE

SA - Strongly Agree
A - Agree
N - Neutral
D - Disagree
SD - Strongly Disagree

Example:	SA	A	N	D	SD
Airplane pilots are interesting people.	___	___	___	___	___
1. After a short training session, workshop participants will be capable of operating the VTR.	___	___	___	___	___
2. A big advantage of the video tape approach is that any portion may be stopped or replayed for further study.	___	___	___	___	___
3. Teachers can learn as much from a properly constructed video tape which is activity oriented as they can from a live presentation.	___	___	___	___	___
4. The activities of a particular program should be done immediately after viewing the tape.	___	___	___	___	___
5. The activities should be undertaken on a strictly voluntary basis.	___	___	___	___	___
6. It is necessary that one do the activity before attempting it in a live classroom situation.	___	___	___	___	___
7. It would be difficult to do the activity if the required materials are not provided along with the video tapes.	___	___	___	___	___
8. I would like to participate in a non-structured teacher-centered workshop utilizing materials such as these: video tapes, etc.	___	___	___	___	___

9. Doing the video taped activities and preparing a teaching unit would be enough requirement for a pass grade in an inservice program. — — — — —

10. I feel teachers would prefer taking a video tape inservice program at their school to commuting to a central point for classes. — — — — —

11. Video tapes, using an activity format, on topics requested by inservice teachers would be effective for inservice courses. — — — — —

12. Generally, the idea of non-structured teacher-centered workshops is great. — — — — —

13. Non-structured, teacher-centered workshops can be effective using only the video tapes and supportive materials. In other words, a workshop coordinator is not necessarily needed if the tapes and materials are available. — — — — —

14. The content of this series is excellent. — — — — —

15. Please comment on ways you feel the series and/or its use can be made more effective.

____

____

____

____

____

____

APPENDIX D

Activities in Aeronautics for Elementary Teachers

AIR AND ITS PROPERTIES

EVALUATION ACTIVITIES

Upon completion of viewing the video tape, the viewer will be able to complete the following tasks:

1. Given a fan and a paper streamer, the viewer will be able to demonstrate that air is present in the Earth environment. The viewer will be able to state the name of moving air as wind.

2. Given an aquarium or similar sized container of water and two clear water glasses, the viewer will be able to demonstrate that air is visible in water.

3. Given a rubber balloon, paper bag, plastic bag, soap pipe or film wire and soapy water, the viewer will be able to demonstrate that air takes up space. The viewer will be able to state that air takes up space.

4. Given two balloons, a dowel, string, and a pin, the viewer will be able to construct a balance scale and demonstrate the balloons are equal in weight. Using the pin, the viewer will demonstrate by breaking one balloon, that air has weight. The viewer will be able to state that air has weight.

5. Given a sheet of film plastic, a pattern, string, weight, scissors, and a self sticking mail label, the viewer will be able to construct a parachute. The viewer will be able to demonstrate how a

parachute operates.

6. Given a commercially produced kite kit, the viewer will be able to properly assemble it.

7. Given a helium filled balloon, a postcard, sandwich bag, and string, the viewer will be able to launch a properly documented weather balloon.

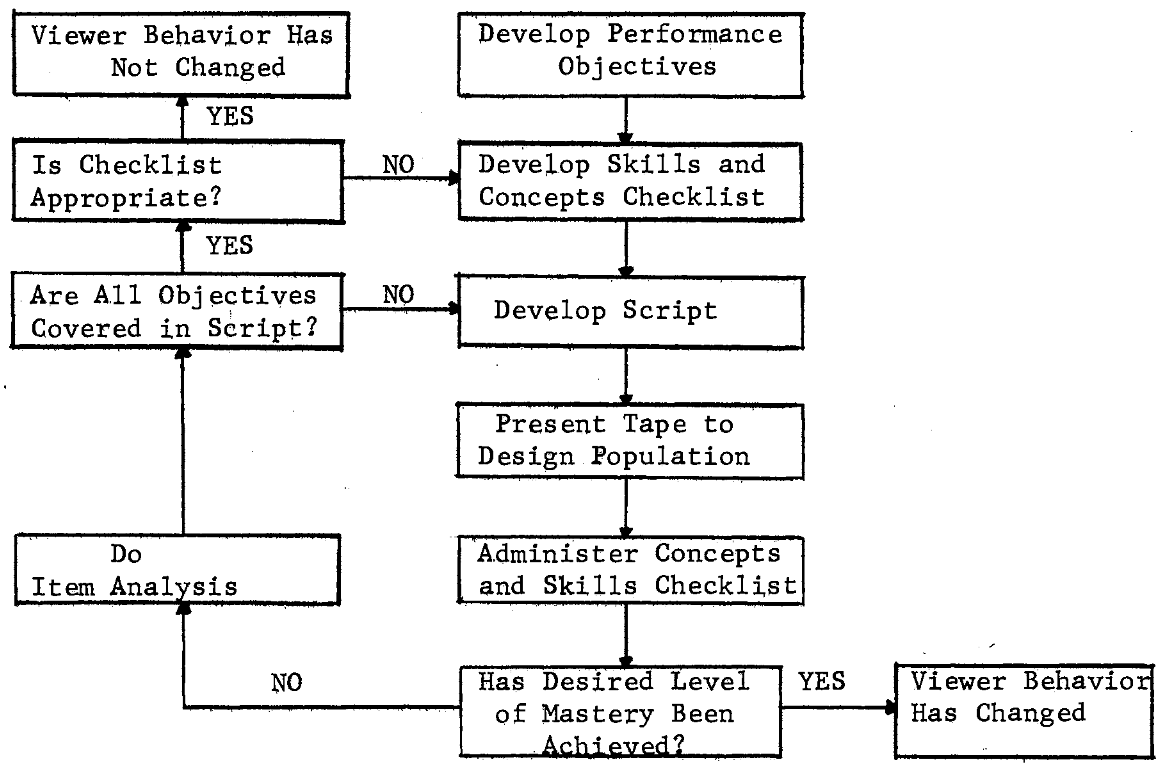
APPENDIX E

An Evaluation of the In-Service Video Tape "Maintaining the Aquarium"

Based upon experience, a procedure was evolved for producing in-service video tapes to effect behavioral change. Briefly the steps are:

1. With the help of a consultant, develop the desired performance objectives.
2. Write an appropriate skills and concepts reinforcement instrument based upon these objectives.
3. Develop a script which not only mentions but visually exhibits the successful achievement of the desired objectives.
4. Produce the video tape.
5. Present the tape to the desired public.
6. Administer the evaluation checklist to reinforce the desired concepts and skills. Item analysis will provide information to modify the video tape.

The following flow chart exhibits the logic underlying this approach to curriculum development and administration.



This model was used to develop the video in-service tape "Maintaining the Aquarium". On March 3, 1972, this tape was presented to a group of librarians at the South Central District of OEA at Norman, Oklahoma.

TABLES OF SCORES

SCORE	f	PERCENTAGE	PERCENTILE
95-100	7	23.3	100.0
89-94	9	30.0	77.7
83-88	8	26.7	47.7
78-82	5	17.7	21.0
70-77	1	3.3	3.3

Mode - 94
Median - 94
Mean - 90

10th Percentile - 80
20th Percentile - 82
30th Percentile - 85

Using the given model and entering the feedback loop, the short comings of the tape become readily apparent.

Item 2-2: The presenters mentioned that cloths were useful in cleaning an aquarium. However they did not show and mention the use of the cloth in the proper operation. Therefore, over ninety percent of the subjects failed to check this item. This is a production error and "cloths" should be deleted from further checklists.

Item analysis shows only a scattering of missed objectives in the remaining items. The best possible method for circumventing these misperceptions is:

1. If an item is to be selected on a printed sheet, it should be presented in the tape in a printed form. This can be done by superimposition or by using printed cards.
2. If a sequence of events is to be ordered on paper, then it should be presented in the video tape, in writing, in the proper order.

It is my opinion that by using the two described procedures, that the performance levels of the teachers on the checklist can be greatly improved.

One note of caution is that a high performance on the checklist will not necessarily evaluate the success of the video tape. If the topic is cleaning an aquarium then the only visible change of behavior would be for a subject to successfully clean an aquarium.

The same procedure involved in the first evaluation was implemented on June 8, 1972, at Cameron College, Lawton, Oklahoma. The respondents were in-service counselors working on a revision of the state curriculum guide.

TABLE OF SCORES

SCORE	f	PERCENT	PERCENTILE
95-100	13	65	100
89-94	4	20	35
83-88	2	10	15
78-82	0	0	5
70-77	1	5	5

Mode - 95
Median - 95
Mean - 94

10th Percentile - 82
20th Percentile - 88
30th Percentile - 92

Item 2-2 was again selected for analysis since the use of a cloth to clean an aquarium is inferred but not explicitly demonstrated.

Eighteen of the twenty respondents did not select "cloths" as a correct response.

Item 2-9 was also of interest since a concentrated effort was made to use both audible and visual information to emphasize the use of "rock salt" to clean gravel in an aquarium.

Nineteen of the twenty respondents selected "rock salt" as a correct response.

ECOLOGY

Miniature Environments

Maintaining the Aquarium

Behavioral Objectives:

Upon completion of viewing the tape and completing the concept checklist, the viewer will be able to:

1. Identify by selecting from a list of evidence, the item or items which indicate a need for aquarium maintenance.

2. Select from a list of items the five instruments needed for cleaning the aquarium.

3. Place a sequence of events in a logical order for emptying an aquarium.

4. Place a sequence of events in a logical order for cleaning, and refilling the aquarium.

CONCEPT AND SKILL CHECKLIST

1. Select the items which are indicators of when an aquarium needs maintaining.

   _____ 1. Growth on aquarium tank walls.

   _____ 2. Low water level.

   _____ 3. Heavy collection of black or green matter on aquarium gravel.

   _____ 4. Bubbles collecting on water surface.

   _____ 5. Passage of four months since last maintenance.

2. To properly clean an aquarium you need:

   _____ 1. A glass scraper

   _____ 2. Cloths

   _____ 3. Glass or window spray

   _____ 4. One or two buckets

   _____ 5. Fish net

   _____ 6. Gravel filtering apparatus

   _____ 7. Tank heater

   _____ 8. Siphon

   _____ 9. Rock or table salt

3. Number the following steps in such an order that they represent a logical method of emptying the aquarium.

   _____ A. Remove decorative items. Remove all living organisms both plant and animal and place them in container with dechlorinated water.

   _____ B. Stir up gravel.

   _____ C. Siphon off water.

   _____ D. Remove tank heater, lamp, and pump hoses.

4. Number the following steps in such an order that they represent a logical method of cleaning and refilling the aquarium.

   _____ A. Rinse salt brine, algae, and waste materials from gravel.

   _____ B. Add two tablespoons of salt and cover sand, decorative items, and filters with water. Let stand for twelve hours.

_____ C. Refill aquarium as directed in "Establishing the Aquarium."

_____ D. Scrape water deposits and algae from tank walls.

VITA

Robert Morris Jones

Candidate for the Degree of

Doctor of Education

Thesis: AN APPLICATION OF SYSTEMS ANALYSIS TECHNIQUES IN THE DEVELOPMENT OF INSTRUCTIONAL TELEVISION UNITS FOR INSERVICE ELEMENTARY TEACHERS

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Education: Attended public school in Ada, Oklahoma; graduated from Ada High School, Ada, Oklahoma, in 1955; received the Bachelor of Science degree from the University of Oklahoma, Norman, Oklahoma, in 1963 with a major in mathematics; completed requirements for a Bachelor of Science degree in education in 1964; received the Master of Teaching degree from East Central State College, Ada, Oklahoma, in 1964 with a major in mathematics education; received a secondary teaching certificate for the state of Texas in 1965; attended Oklahoma State University, Stillwater, Oklahoma, from September, 1970, until May, 1972; completed requirements for the Doctor of Education degree at Oklahoma State University in May, 1973.

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