A STUDY OF AEROSPACE EDUCATION WORKSHOPS WHICH UTILIZE NASA MATERIALS AND RESOURCE PERSONNEL

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PREFACE

The concern of this study has been to determine who attends an aerospace workshop and what they might have gained professionally. As this is primarily a descriptive study, it gives a broad picture of aerospace workshops across the United States.

Dr. Kenneth Wiggins is acknowledged for his encouragement and suggestions as the study was done. Grateful acknowledgment is due also to the advisory committee: Dr. Herbert Bruneau, Dr. Robert Brown, Dr. D. L. Rutledge, and Dr. Alex Ross for their time and suggestions.

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When it comes to doing the work, I am in debt to Eileen Edwards of the NASA Ames Research Center for all the computer programming. The finesse of putting the study into acceptable form to negotiate requirements was due to the efforts of Eloise Dreessen of the OSU Research Foundation.

My wife, Darlene, consoled and inspired me throughout the project.

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CHAPTER I

INTRODUCTION

Adult education or continuing education for adults has become a more important part of education in the past two decades. The need for periodic continuing education for professional people has become a necessity because of the fast changes in professional procedures due to technological advances. Although the terminology associated with adult education is sometimes confusing, this study shall refer to postgraduate work as done by teachers (6).

Background of the Study

The need of teachers to meet standards of certification and professional awareness in their field has created a revolution in American higher education (15, 27). The role of the educational specialist proficient in philosophy, techniques, materials, and application has evolved as a part of almost every teaching staff (19). In some locations continuing teacher education is compulsory in-service training from the day of appointment to the day of retirement, especially in large schools, such as in New York City, where competent teachers often remain 10 to 15 years in one school system. Schenberg (19) says:

> However, a course of study is not worth the paper on which it is written unless teachers are prepared to teach it; unless necessary facilities, equipment, and supplies are provided; and unless new and revised textbooks are made

> available for the students. For the most part, preparing teachers to teach any of the new courses is an in-service undertaking [p. 36].

Workshops are one type of group activity often used to involve teachers in continuing education development programs. The characteristics common in most workshops are that the consultant assists workshop members to cooperate among themselves to develop plans, skills, and competencies. The atmosphere of the workshop is conducive to the esprit de corps of the group making the workshop a good activity for preservice training and follow-up evaluation of the workshop theme throughout the year (1).

The basic concept of workshops was developed during the 1930s by the Progressive Education Association. Initially, the workshop was to gather a number of teachers from a single discipline together and, with materials and resource persons available, they were to identify and discuss solutions for the problems they would have in common. A plan of operation including group meetings was made after the participants arrived. Though a workshop member was expected to work on committees, no individual assignments were made. The implementation of workshop results was ensured by maintaining communication within the group by occasional meetings and round robin letters (27).

Examples of the comments of teachers after being involved in a workshop are as follows:

> The workshop set me on the right road, gave me objectives, and helped me formulate my plans for approach and motivation. It made me realize that every teacher needs to go back to college periodically and to keep informed of developments in his field.
>
> This workshop has helped us to have a better understanding of the sequential program and to develop such a program from the third grade through junior college level [24, p. 22].

In October of 1957, the Space Age began jolting the interest of America in education, especially in sciences and mathematics. On October 1, 1958, the National Aeronautics and Space Administration (NASA) became an agency by congressional act, dedicated to "preservation of the role of the United States as a leader in aeronautical and space technology and in the application thereof to the conduct of peaceful activities within and outside the atmosphere [14, p. 3]."

With public information being a part of the Space Act of 1958, an Educational Programs Division became a part of the NASA Public Affairs. In a report of NASA Services to college and university summer sessions, it states:

> There are no existing agencies or organizations, either public or private, other than those for public affairs and education in NASA that have access to the knowledge, that have the personnel, and that have the positive mandate to perform the unique and essential educational service of providing "the widest practicable and appropriate dissemination of information concerning its activities and the results thereof."
>
> The Educational Programs Division of NASA Headquarters can be of maximum service to education by concentrating its efforts on such activities as the following: overall planning, liaison with national and state educational agencies and organizations, the stimulation of educational research, the encouragement of publications, experimentation with workshops and conferences, the encouragement of the production of audio-visual materials, the stimulation of exhibits including the fabulous Spacemobile program, and the articulation of the field installations [14, p. 5].

By 1963, NASA was involved in supporting over 140 Aerospace education workshops throughout the United States each year (3). With publications and support to teacher training institutions developing further during the following years, NASA began to emphasize the need of better teaching activities for the classroom teacher (4).

Evaluations have been made of the NASA Spacemobile during its

operations of presenting lectures at schools throughout the school years. However, the workshop programs on campuses each summer throughout the country have been evaluated only on the basis that NASA was usually asked to come back and be a part of the program the following year.

By 1970, NASA was not only supporting aerospace workshops, but also acting as a sponsor of workshops at several of its centers. The questions of workshop content were answered basically by the NASA persons most experienced in workshop participation, but at this time, NASA Educational Programs foresaw the need to evaluate all existing participation in educational workshops in order to adequately plan its services to be available in the future.

This study concerns itself with a description of the workshop, the nature of the involvement of NASA in these workshops, and the evaluation of how workshop participants felt about the workshop experience when asked six months later.

Specific Statement of the Problem

The principal objective of this study was to discover how the workshop participants felt about summer aerospace workshop six months later. Research on the principal objective demanded the development of a questionnaire to be given to them during the workshop and also the development of a second questionnaire that was mailed to them six months after they had completed the workshop.

Specifically, the study attempted to ascertain significant differences, as mentioned in the hypotheses.

Hypotheses

Though many questions arise in this type of study, it is impossible to look for the answers to all of them. Following are four major null hypotheses which were tested with data of this study.

Hypothesis 1. There is no relationship between the length of the workshop and the number of techniques or activities the teacher includes in lesson plans as a result of the workshop experience.

Hypothesis 2. There is no relationship between the duration of the NASA representation at aerospace workshops and the number of techniques or activities included in lesson plans as a result of the workshop experience.

Hypothesis 3. There is no relationship between the duration of NASA representation at aerospace workshops and the extent to which the workshop participant is of assistance to their faculty by talks or as a resource person.

Hypothesis 4. There is no relationship between the group dynamics of having the workshop participants work in subgroups and the number of techniques or activities the teacher includes in their lesson plans as a result of the workshop experience.

Need for the Study

NASA has supported aerospace workshops across the United States for several years. Time, effort, and money are required to do this. Therefore, with the growing interest in aerospace education, a survey was needed to describe these various workshops, to describe the role of NASA at these workshops, and to evaluate how the workshop participants felt about them.

Limitations of the Study

There were several limitations involved in this study,

1. The population of the first questionnaire was teachers who attended aerospace workshops which were in session.

2. Since answering the first questionnaire was not on a voluntary basis, there may have been some covert reluctance on their part to participate in this study with full enthusiasm.

3. The second questionnaire was mailed to a random sample of 500 previous workshop participants. There was a 48 percent return from these.

4. The computer answer cards for the first questionnaire were printed with the question and choice of answer blocks on the card, and the answer choices were printed on a separate sheet of paper. This led to considerable confusion in going from the card to the answer sheet and back to the card.

5. For the first questionnaire, two computer cards were needed to contain all the questions. While passing these out to participants, some who gave out the exam did not pass them out in matched pairs. This meant that data from several workshops had to be discarded.

Assumptions of the Study

The following assumptions were made:

1. A questionnaire approach would be a valid way of describing the workshop, describing the nature of the involvement of NASA to these workshops, and the evaluation of how workshop participants felt about the workshop.

2. The questions that were asked would be suitable for the data interpretation.

3. The follow-up random sampling is a valid sample of the total population.

Definition of Terms

Aerospace Education. The realm of education that concerns an awareness of the implications of aviation and space flight on our present way of life.

NASA Public Affairs. A division of the National Aeronautics and Space Administration which is responsible for carrying out the congressional mandate that the public receive "the widest practicable and appropriate dissemination of information concerning its activities and the results thereof [p. 2]."

NASA Office of Educational Programs and Services. The branch of NASA Public Affairs concerning itself mainly with service to students, educators, and educational institutions.

Spacemobile. A mobile van of demonstration equipment and models accompanied by a space science lecturer which visits schools and campuses.

Workshop. Instruction through group participation for persons experienced in their professional field to upgrade their capabilities of handling problems common to the group.

Activities. Group participation to develop teaching skills or capabilities.

First Questionnaire. The questionnaire which was sent to workshop directors during the summer of 1970.

Second Questionnaire. Follow-up questionnaire; the questionnaire sent to 500 randomly selected former workshop participants six months after the workshop.

Organization of the Study

This study is composed of five chapters. Chapter I is the introductory chapter and contains sections which relate to the background of the study, the specific statement of the problem, the hypotheses to be tested, the need for the study, the limitations of the study, the assumptions of the study, and the definitions of terms mentioned in the study. Chapter II is entitled "Review of the Literature." In that chapter, pertinent literature is discussed under the topic headings of: "Origin of the Workshops," "Evolving Structure of Workshops," "The Effect of Federal Involvement with Workshops," "NASA's Participation with Workshops," and "Summary." Chapter III is concerned with methodology and design. That chapter includes a description of the subjects, questionnaire development, questionnaire administration, and analysis procedures. Chapter IV contains the findings of the study. Topic headings of that chapter include: "Context Evaluation," "Process Evaluation," "Product Evaluation," "Analysis of Chi Square Tables," and "Summary of the Findings." Chapter V bears the title of "Summary, Conclusions and Recommendations."

CHAPTER II

REVIEW OF THE LITERATURE

The Origin of Workshops

The term "workshop" in education is an outgrowth of seminar type instruction starting in 1936 by the Progressive Education Association. The Progressive Education Association had held several summer conferences with staff members of 30 schools prior to 1936. These meetings were valuable in exchanging ideas concerning curriculum, but were not adequate to meet the aims and purposes of individual schools, so a more intensive plan of in-service study by teachers was found necessary (18).

In the summer of 1936, accordingly, the two commissions jointly conducted a six-weeks seminar at Ohio State University wherein teachers in science and mathematics from the 30 schools divided their time between the curriculum and evaluation. This direct access to research findings and consultation with specialists proved so helpful that it was decided to expand the idea the following summer, and in 1937, a "Workshop" was held at Sarah Lawrence College, Bronxville, New York, the leadership being furnished by three commissions of the Progressive Education Association--the Commission on the Relation of School and College, the Commission on the Secondary School Curriculum (including the Adolescent Study), and the Commission on Intercultural Education. In attendance were 126 teachers and other school workers from

educational institutions all over the United States. A requirement for admission was that the individual have some definite problem on which he was working by himself or as a member of a school group, and the method used was that of consultation, conference, and small group discussion. Commission reports then in process on "Science in General Education," "Creative English," and "Life and Growth," together with case study material on adolescent growth and development compiled by Dr. Caroline Zachry and her staff, and motion pictures selected for school use by the Commission on Human Relations under Dr. Alice Keliher, were made available for discussion and criticism by participants in the workshop. Evaluation materials were also provided and a laboratory for the evaluation work. The sum total of these resources produced what Dr. V. T. Thayer, Chairman of the Commission on the Secondary School Curriculum, characterized as "a new phase in the professional education of teachers," [18, p. 5.]

So pronounced was the success of the Sarah Lawrence Workshop of 1937 and so likely did it seem that a new way had been indicated for in-service education of teachers that resources were sought and obtained for a more ambitious program in 1938 (18).

Three workshops were set up with funds from the Rockefeller Foundation during the summer of 1938 at Sarah Lawrence College, Bronxville, New York; Colorado Women's College, Denver, Colorado; and Mills College, Oakland, California (18).

Key people to staff the three workshops were gathered together for a ten day "leadership conference" near Detroit, Michigan. The briefings of the workshop directors and staff members together gave them a better understanding of their tasks and somewhat closer coordination between

them. In order to meet the objectives of the workshop, the spirit and sincere effort to carry out certain fundamental principles that had long been neglected from American education were emphasized:

1. Concern for the needs of individual human beings in direct relation to the demands of the community.
2. Insistence upon a rich experience of living as essential to all education, but particularly in the education of teachers.
3. A scientific approach to the understanding of human beings and society that makes full use of modern instruments of evaluation, but views these not as important in and for themselves, but primarily as help to achieving educational objectives that grow out of reasoned philosophy of life in which human welfare and human happiness are placed uppermost. [18, p. 14]

The participants selected to attend the workshops were chosen from areas which had been specified to have definite problems of their curriculums. In solving their own problems, the participants were separated into discussion groups, and as much time was afforded to counseling by the staff as possible. Evaluations of the summer workshops of 1938 emphasized the amount of inspiration which evolved from working in small groups and subgroups. Apparently, no credit hours were given to these workshops which tended to promote a greater amount of cooperativeness among participants and staff (18).

By 1941, the workshop type of study had been adopted to many disciplines for teacher training purposes. One of these was the Michigan Community Health Project, sponsored by the Kellogg Foundation (12). This series of workshops was organized to help teachers use their own community resources to improve the scope of their teaching. The workshops included the disciplines of health education, science education, social science, library science, language arts, and democratic citizenship. The workshops were more highly structured than those of the late

1930s discussed previously in that lectures were given, field trips were taken, a laboratory school was used, and college credit hours were given (16).

In science education the group meetings were mostly in the areas of biological science, science curriculum problems, and community resources. At the end of the six-weeks workshop, evaluations were made of both the course and the participants. The staff judged the course to be quite effective in teacher training and, overall, gave the workshop participants above average grades (16).

The participants of the workshop concluded the evaluation with summations that:

1. they had made progress on their problems,
2. their subject matter background had been improved, and
3. they felt their teaching would be modified as a result of the workshop (16).

The main characteristics of workshops where teachers develop solutions to their own teaching problems and the common workshop activity of relating the disciplined problems to community living are consistent with the interpretation of integrating democracy into the curriculum. A participant of one of the first organized workshops described the learning experience as follows:

> The experience of entering into a rhythm of thinking, feeling, playing with a group of adults; the freedom of the individual in participating in groups as well as in planning of his programs; the emphasis which has been put upon the development of the whole child; [18, p. 30]

And she asserts that what affected her most seriously in the workshop were, "the realization of the meaning and practice of a democratic form of living." [18, p. 30]

According to Ryan and Tyler (18), a contributing factor to these sentiments is the fact that the participants of a workshop are of similar backgrounds working together on similar problems and probably have more sympathy for the professional opinions of each other than a mixed group might have.

The definition of a workshop 15 years later, according to Weaver (25), was as follows:

> The increasing use of the workshop calls attention to its importance as an educational device for mature and experienced persons. A "workshop" may be defined as a group of people working together democratically toward the solution of problems of mutual concern [p. 1].

Evolving Structure of Workshops

The inclusion of workshops as a means to communicate ideas is indicated as beneficial, especially when working with groups. According to Barr and Appleton (2), training activities are included in the workshop, and a description of supervision techniques expressed in a workshop are as follows:

> The workshop is a splendid example of the difficulties involved in more categorizing improvement techniques.
>
> It appears to be primarily in a group technique. It has also many individualizing aspects and relies upon a variety of means such as talking, listening, reading, writing, and doing. It has been classified here as a group technique because of its emphasis upon cooperative and democratic methods of doing things. It has been classified as a doing technique because of its great emphasis upon learning by direct contact with the thing to be learned. Doing techniques in the field of teacher education are, however, of two sorts: (1) those involving participation in the total teaching act; and (2) those providing participation in various sorts of preparatory activities. The workshop provides opportunities to do in the latter sense [p. 21].

The Guide for Resource-Use Education Workshops by the American Council of Education (25) in 1951 includes each phase of planning a

workshop. The program of the example had progressively become more structured than in prior references of years before. Among the contents of the guide are "Choice and Use of Techniques," which includes the areas of group discussion, panels, symposiums, lecture discussions, role playing, interviews, surveys, observations, field trips, teacher observation, demonstration, audio-visual aids, reading, recording and reporting, action projects, and development of teaching units. An extensive discussion of evaluation procedures is also a part of the guide as well as an extensive bibliography of references on workshops. This guide clearly defines the acceptance of the workshop as an educational device for the in-service training of teachers (25).

The Workshop Way of Learning by Earl C. Kelly (13), also written in 1951, gives specific examples to show the personal approach to conducting a workshop. This book also covers the complete gamut of workshop preparation from "Principles and Purposes" through "Evaluation," but included more consideration to the "Short Workshop" and "Conclusion" following evaluation.

The purposes for workshops, defined by Kelly (13), are listed below:

1. We want to put teachers in situations that will break down the barriers between them so that they can more readily communicate.
2. We want to give teachers an opportunity for personal growth through accepting and working toward a goal held in common with others.
3. We want to give teachers an opportunity to work on the problems that are of direct concern to them.
4. We want to place teachers in a position of responsibility for their own learning.
5. We want to give teachers experience in cooperative undertaking.
6. We want teachers to learn methods and techniques which they can use in their own classrooms.

7. We want teachers to have an opportunity, in collaboration with others, to produce materials that will be useful in their teaching.
8. We want teachers to be put in a situation where they will evaluate their own efforts.
9. We want to give the teachers an opportunity to improve their own morale [p. 11].

Item number six had, by the 1950s, appeared to be the prime function of workshops. But, the factor of morale boosting as discussed in item number nine, has always spearheaded the list of popular purposes of workshops by teachers.

Characteristics of the workshop could be listed rather briefly in 1940, but keep in mind that at that time, the workshop was a new innovation to education. The following is the list of Heaton's (10) 13 essential characteristics of the workshop:

1. The participant is given an opportunity to make an intensive study of an interest which has arisen out of his experience as a teacher.
2. The participant shares in planning a program of individual and group activities designed to meet his needs and those of his fellow workers.
3. The participant is provided with easy access to the services of various staff members, representing a variety of kinds of assistance.
4. Individuals with common problems should form tentative and flexible groups for work.
5. Participants should do the bulk of the work on their own problems.
6. The planning and process of the workshop is cooperative and participatory throughout.
7. The personal and social growth of individual participants should be fostered as well as the solution of their professional problems.
8. Evaluation is continuous and exercised on product and processes, not on persons.
9. The length of the session must be adequate.
10. The collection of resource materials of all kinds likely to be of value to participants should be as extensive as finances permit.
11. The instructional staff should represent a wide diversity of personnel.
12. The full-time staff may be based on the ratio of one member for each 12 to 15 participants. Some of the specialists may be on a part-time basis.

13. The physical facilities should permit varied experiences [pp. 7, 11].

The list of "essential characteristics" listed above are basically similar to Kelly's (13) "purposes of a workshop" listed earlier with the exception of items eight and nine.

Item eight covers the subject of evaluation of the workshop by its participants. O'Rourke (15) suggested that evaluation should be taken at least once during the workshop and at the conclusion.

Item nine discusses length of the workshop as being adequate at six weeks and that three weeks is an absolute minimum. This comment is interesting since a similar statement was made by participants of what was one of the first real workshops in 1938 (18).

Change in amount of organizational structure is very definite from the descriptions of a workshop as noted in how Heaton (10) and O'Rourke (15) differ in their expressions of what a workshop should be. An interesting inclusion in the description of workshops by O'Rourke also is a list of what a workshop is not.

1. It is not a series of lectures, nor a series of meetings, nor a symposium, nor a conference, nor an institute.
2. It is not a device for orienting new teachers, nor for giving in-service training to beginners, to understand recruits. It is of no use for inexperienced personnel.
3. It is not a research situation, though a good deal of research technique may be involved. Educational leaders need, incidentally, to make sharper distinction between research techniques and study skills than is commonly made. Much that is labeled research, particularly "library research," is nothing more than the exercise of well known study skills [pp. 9-10].

In August of 1962, Karbol (12) conducted a study of 37 language arts teachers participating in a two week workshop in Detroit, Michigan, Karbol evaluated the participants, both during the workshop and later

during their school year; and the participants were evaluated by their co-workers, their principals, and the administration.

From the participants of the workshop and persons closely associated with them in the teaching community, the following is a part of conclusions made concerning the effect of workshop experience:

From the Participants:

Teachers of all levels of experience were able to find means to enrich their school environments. Contrary to popular belief concerning the adaptability of the more experienced teacher, it was found that the teacher with more than ten years of teaching experience was as sensitive and responsive to new ideas as were any of the teachers in the workshop.

From the Co-workers:

There was some evidence that the stature of the Key Teachers was enhanced by their experiences and that upon reporting back to their fellow teachers they were sought after as resource people, committee members, demonstration teachers, and "strong shoulders."

From the Principals:

Greater reliance was placed on the help of the Key Teachers in interpreting school policy to other teachers in leading curriculum improvement committees, and in speaking on curriculum matters to parents.

Communication lines between the Key Teacher and the principal were made stronger.

Principals considered the greatest gain was had by those who actually participated in the workshop with some carry-over into the rest of the staff. It was generally thought that one workshop by itself could not be expected to create vast change in all sections of the school program.

The principals exhibited uniform pleasure in the dynamics displayed in this workshop and the opportunity it afforded them to use the talents of the Key Teachers to rethink selected phases of the school environment.

From the Administration:

The workshop was an excellent means for integrating the abilities of the various teachers for the betterment of the district. There was a decided force of enthusiastic teachers at work in each school.

And from the Implications of the Study:

Principals and other supervisory personnel are best aware of the limitations of time inhibiting their best intentions for promoting in-service education practices

> which are necessary. Teachers, who are self-directive and self-evaluating, are the surest antidote for this condition. It has been seen that a workshop, under the proper conditions of worthwhile goals, a good director, and open-minded teachers can accomplish a great deal toward fulfilling this need [pp. 123-30].

From the periodical literature on workshops during the past few years, it is interesting to note the increasing amount of structure listed in the organization of workshops. A general description of a functional workshop is given by Carrol (5) as follows:

> Though "workshop" is a term used in a great variety of ways, it denotes one common thread of concern: to translate theory into practice. During recent years, the workshop has grown increasingly important as an in-service education arrangement to help teachers refine local educational objectives in the perspective of emerging national goals and translate those objectives into effective classroom programs.
>
> Too many workshops, however, because they are unstructured, turn out to be little more than academic study groups. If a workshop is to be what it purports to be, namely a "workshop," it needs to be carefully structured in the act of "doing" rather than the act of "listening." In other words, a purposeful workshop is an activity, an activity having its beginning in the recognition of a problem and in the decision to allocate a solution, or at least informing resources, for that problem [p. 13].

Carrol (5) further lists the typical structured workshop as follows:

Phase 1. Identification of a problem.
Phase 2. Gathering information.
Phase 3. Problem mounting.
Phase 4. Organizing information.
Phase 5. Follow-up.
Phase 6. Evaluation [p. 14].

The Effect of Federal Involvement With Workshops

When the National Defense Education Act (NDEA) was passed in 1958, the intent was that every American should have the opportunity to develop his skills and competencies in the fullest extent. The amended

Title III NDEA was to strengthen instruction in science, mathematics, modern foreign language, history, civics, geography, English, and reading in elementary and secondary schools (17).

The need to train teachers in new subject matter areas in order to do better jobs was implemented through NDEA programs. The demand for elementary teachers being upgraded was also a problem. Following is a description of the problem as stated by Hill (11) in 1962.

> In the face of the need for another look at elementary teachers' science problems, we find already crowded campuses and college teaching staffs in a struggle to meet the demands of a fresh, young, science-oriented college enrollment. Merely to offer the elementary teachers an equal opportunity to enroll in the science subject-area courses side-steps the real issue. The science pressure in recent years has offered mute evidence that certified elementary school teachers are not inclined to form a legion enrolling in college-level physical science courses. Even if elementary school teachers were to be offered stipends for enrollments in summer institutes or in-service courses compared to those provided secondary school teachers by the National Science Foundation, the need for an appraisal of the true needs of our elementary school teachers will remain.
>
> It is not impossible that the workshop, the in-service course, or the summer institute might offer avenues of solution. Some creative and courageously imaginative minds are needed [p. 153].

NASA's Participation in Workshops

Further government interest in education was the NASA involvement with institutions as a part of upgrading teachers in the Space Age to make the teachers capable of handling the space science concepts that could be taught at their level and, secondly, to make the teacher aware of more recent examples of these concepts. Characteristically, the lag time had been approximately four years from discovery of knowledge to its being taught. The NASA educational purpose was to shorten this

time gap by direct communication to teacher groups (23).

The aerospace workshop, an outgrowth of aviation education workshops that have been conducted on campuses since the late 1940s, took on new emphasis. In workshops up to 1962, the Aviation Education Committee of the American Association of Colleges for Teacher Education recommended the following objectives:

1. An adequate reading and speaking vocabulary of aviation.
2. Knowledge of the importance of weather and climate to successful aviation.
3. General knowledge and understanding of the simple scientific principles of flight.
4. Understanding the place of aviation in peace and war.
5. Understanding the effects of air transportation on various levels of international relationships.
6. Introduction of the social, economic, and political implications of current and future aviation development; a realization of the growing interdependence of people through aviation.
7. Appreciation of the services rendered by airports and their associated personnel.
8. Knowledge of available aviation education resources in materials, personnel, and equipment for instructional purposes.
9. The know-how for organizing units of aviation education and providing resulting learning experience for children through student or directed teaching [7, p. 17].

The concepts of space science began to permeate the aviation education workshops and, by 1963, the name of aviation education had been supplanted by the term "aerospace education." The National Aeronautics and Space Administration created the Office of Technical Information and Educational Programs within its organization to support educational institutions in the following areas:

1. Assisting schools and colleges in structuring courses, seminars, and institutes in space science, and providing resource people, visual aids, and space-science demonstrations.
2. Developing and making available pamphlets, booklets, brochures, and instructional materials to assist educators in their timely space-education efforts.

3. Developing and distributing to educational groups films, slides, charts, and exhibits designed to promote better understanding of space science, related technology, and the many implications of space exploration.
4. Developing "Spacemobiles" to bring to school and college groups a mobile space-science unit, utilizing special equipment to demonstrate basic principles of rocketry, launching and orbiting of satellites, deep-space probes, and examples of significant space experiments achieved by spacecraft such as Tiros, the weather satellite; Echo, the communication satellite; and Pioneer, V, the sun satellite.
5. Cooperating with national, state, and local educational organizations, and with aerospace industries to engender programs in space education and participating in the programs of many educational organizations.
6. Cooperating with educational television and commercial TV stations and networks in production and presentation of space programs [8, p. 570].

James Webb (26), Administrator of the National Aeronautics and Space Administration in 1962, made the following comments concerning part of the contributions of NASA to education:

> Our Office of Educational Programs and Services is working closely with many of the National Education Association affiliates, with the U. S. Office of Education, with the National Science Foundation and with other national organizations and groups having an interest in and responsibility for education.
>
> We are utilizing NASA's scientific and technical sources of space information to develop materials for books, booklets, pamphlets and educational publications, in cooperation with practicing educators. We are making available to the public in useful form much of the exciting motion picture footage on our rocket launches, on the work of our scientific satellites, and on many other unusual and intriguing technological developments. We are working diligently to make as much as possible of this type of information available to classroom teachers and to adult groups across the nation and around the world.
>
> We are assisting colleges and universities in organizing and conducting workshops and other programs designed to provide teachers all age and grade levels with better understanding of space science and technology and of the implications of our rush into space.
>
> One of our most successful educational service undertakings has been the spacemobile program. The exhibits and lecturers aboard the spacemobile provide the school, college, or lay audience with accurate, up-to-date information on

> space science and exploration. A typical demonstration is about 50 minutes long and answers 6 basic questions: What is a satellite? How does it get into orbit? What keeps it in orbit? What does it do? What good is it? What are NASA's plans for future research and space exploration? [26, p. 87].

The support of NASA to education, via providing assistance to teacher workshops, has been carried out primarily by Spacemobile lecturers. These lecturers are specialists in education, being well prepared in teaching techniques as well as space science concepts. The unit of each lecturer contains a set of rocket and satellite models plus audio-visual materials to present lecturers to student audiences or teacher workshops. The most often used practice in workshops is the NASA resource person actively participating for three-to-five-days, presenting resource materials and space science concepts through activities to the workshop participants (20).

Summary

Ryan and Tyler (18) described the first workshop held in the United States by the Progressive Education Association in 1936. The first workshops defined the spirit and objectives of the workshop principle. The main characteristics of workshops were to help teachers develop solutions to their own problems. In the later workshops, according to Kelly (15), Heaton (16), and O'Rourke (17), a more specific structure developed and the workable length of workshops became shorter.

Federal involvement in workshops was fostered by the National Defense Education Act of 1958. As monies were more readily available for teacher training, the intent was for each teacher to develop his professional talents to the fullest extent (20). Further government

interest in education was the support of NASA to aerospace workshops by providing resource persons to assist in upgrading the understanding of teachers of space science concepts (22).

CHAPTER III

DESIGN AND METHODOLOGY

Introduction

The purpose of this study is to describe the workshop, describe the participation of NASA in these workshops, and to evaluate how the workshop participants felt about their workshop experience six months later. This description and evaluation was done by having workshop participants answer a questionnaire.

Description of the Subjects

NASA participated in 110 aerospace workshops in 1970. Of these, 86 workshops responded to a questionnaire that was given to them, of which 79 were usable. The first subjects of the study were the 2,007 workshop participants from the 79 workshops mentioned above.

The second questionnaire was mailed to 500 previous workshop participants from the 79 workshops. This 500 was selected randomly. There was a 48 percent return from this group.

Questionnaire Development

The first questionnaire contained 39 questions which covered the areas of description of the workshop participant, description of the workshop, and description of the involvement of NASA with the workshop.

The original questionnaire grouped the questions into these three categories. However, a printing error caused a disorder in the questions; that is, the questions were no longer grouped in the three categories. The computer cards are found in Appendix A. The results of this questionnaire are found in Appendix B. The follow-up questionnaire is contained in Appendix C. The results of this questionnaire are found in Appendix D. Appendix E contains a list of participating workshops.

Questionnaire Administration

The first questionnaire was sent to 110 workshop directors across the United States. The printing of the computer cards for the questions was late so that the cards got to only 86 workshops in time to be presented to the participants.

The workshop directors administered the questionnaire. Each workshop participant needed a pair of matched computer cards to mark their responses. Some directors were not careful in passing out the cards to see that participants got the matched computer cards. This resulted in only 79 workshops returning usable data. There were 2,007 participants who answered the first questionnaire. However, not everyone answered every question due to some reluctance. There was less than 100 percent response to most questions.

In February, the follow-up questionnaire was mailed to 500 former workshop participants selected randomly from the 2,007 who had answered the summer questionnaire. Within six weeks, 245 questionnaires had been returned, totaling a 48.5 percent return.

Analysis Procedures

The first questionnaire was answered on computer cards, which were sent to the NASA Ames Research Center for cross comparisons. The follow-up questionnaire was answered on the questionnaire sheet. The information was then transferred to computer cards at Oklahoma State University. The cards were then sent on to Ames Research Center as the first cards had been done for cross comparison. This information gives the description of the workshop participants and the description of the workshop.

To evaluate the way the workshop participants felt about their workshop experience six months later, the Chi Square formula for determining significance and contingency coefficients was used. According to Siegel (27), the nonparametric statistical test was in order.

In brief, the first questionnaire was used to describe the workshop participants, the workshop, and to describe the role of NASA at the workshop. The second questionnaire also did the above, but was used further to evaluate how the workshop participants felt six months after workshop experiences.

CHAPTER IV

RESULTS OF THE STUDY

Introduction

As a descriptive study, the problems are to view three aspects of aerospace workshops. The first aspect, the context evaluation, is a description of the workshop, workshop participants, and NASA participation in the workshops.

Secondly, an effort is made to determine the amount of participant involvement in aerospace workshops or process evaluation. Generally, a workshop experience includes activities of several types, not only to promote an atmosphere of congeniality, but also to have the workshop participant involved in group-oriented activities to develop new teaching capabilities.

The third portion of this study is to determine the product of aerospace workshops. The usefulness of NASA activities, materials, and participation in workshops is described, as well as participant attitudes and professional growth.

The context and process evaluations of this study are largely made from data of the first questionnaire given to participants during the duration of the workshop experience. The product of the workshop is determined largely from a follow-up questionnaire after the teachers had returned to their teaching position.

Context Evaluation

The context evaluation here describes workshop participants, workshop programs, and NASA involvement in the workshops. With each topic area, tables will show comparisons to give a better idea of the workshops.

Throughout the several tables, an indication of percentage is shown with the number of participants who chose the selection of an answer. The percentages usually do not add up to 100 percent since not all of the teachers of any category would make a selection of answers.

Description of the Participants

The age of participants is taken from question number one of the second questionnaire. Table I compares age to the primary positions of the participants in the school and the length of workshops attended by the various age ranges.

Sex

Similarities and differences in the purposes of men and women in attending are compared in Table II, where sex is compared to the level of education, how they learned of the workshop, and the primary purpose for attending the workshop. In comparing sex to the level of education to sex, it is apparent that the majority of elementary teachers are women, while the majority of other levels are men.

Of possible interest to future workshop directors, according to the comparison with question 19, more men learn of workshops by published notice while more women learned of the workshops from their

TABLE I

CROSS COMPARISON BY AGE

	Under 26		26-35		36-45		46-55		Over 55	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Question Number 1. Age: (second questionnaire)										
	61	(24.9)	53	(21.6)	61	(24.9)	47	(19.2)	20	(8.2)
Question Number 3. Primary position in the school										
Teacher	52	(85.2	48	(90.6)	52	(85.2)	43	(91.5)	17	(85.0)
Administrator	None		2	(3.8)	3	(4.9)	2	(4.3)	3	(15.0)
Supervisor	None		None		1	(1.6)	2	(4.3)	1	(5.0)
Counselor	None		1	(1.9)	None		None		None	
Librarian	1	(1.6)	None		None		2	(4.3)	None	
Other	5	(8.2)	2	(3.8)	2	(3.3)	1	(2.1)	None	
Question Number 17. Length of workshop attended										
1-3 days	5	(8.2)	1	(1.9)	1	(1.6)	3	(6.4)	1	(5.0)
1 week	5	(8.2)	2	(3.8)	7	(11.5)	9	(19.1)	3	(15.0)
2 weeks	15	(24.6)	21	(39.6)	17	(27.9)	10	(21.3)	6	(30.0)
3 weeks	14	(23.0)	20	(37.7)	23	(37.7)	11	(23.4)	9	(45.0)
4 weeks	17	(27.9)	7	(13.2)	6	(9.8)	6	(12.8)	1	(5.0)
6 weeks	4	(6.6)	2	(3.8)	5	(8.2)	6	(12.8)	None	
8 weeks	None		None		1	(1.6)	None		None	
Longer	None		None		None		None		None	

TABLE II

CROSS COMPARISON BY SEXES

	Male		Female	
	Number	Percent	Number	Percent
Question Number 1. Sex: (first questionnaire)				
	739	(36.9)	1,254	(62.6)
Question Number 13. Level of education mostly associated				
Elementary	270	(36.5)	966	(77.0)
Junior High School	203	(27.5)	173	(13.8)
Senior High School	219	(29.6)	89	(7.1)
College	42	(5.7)	10	(0.8)
Question Number 19. Learned of the workshop by				
Public notice	310	(41.9)	418	(33.3)
Instructor	176	(23.8)	272	(21.7)
Associates	118	(16.0)	310	(24.7)
Administrator	125	(16.9)	214	(17.1)
Question Number 29. Primary reason for taking the course				
Undergraduate credit	123	(16.6)	201	(16.0)
Recertification	71	(9.2)	170	(13.6)
Graduate credit	157	(21.2)	221	(17.6)
Proficiency	309	(41.8)	499	(39.8)
Salary increase	94	(12.7)	170	(13.6)

associates. The majority of both men and women learned of the workshops by published notice.

Apparently, a few more men take workshops primarily for graduate credit whereas women attend to a greater extent for recertification. About the same number of men and women indicated similarly their primary purpose for attending the workshop was proficiency in the subject.

Teaching Disciplines

Teaching areas or disciplines are shown in Table III compared to how the teacher learned of the workshop and the NASA materials they feel should be emphasized.

Though published notice is the most usual manner through which participants learned of the workshop, participants with mathematical backgrounds were the highest percentage of this group. The greatest need in every teaching area, according to question 23, concerns suitable activities for classroom use.

Level of Teaching

The level of teaching from elementary to college is shown in Table IV in comparison to the opinions of the workshop participants concerning which type of NASA material would be most valuable for classroom use. The greater percentage of aerospace workshop participants are in the field of science, and the least are in vocational areas and humanities. Interesting here is that the senior high teachers indicate that films and publications are nearly equal in value as teaching aids.

From comparison with the "area most closely associated," 61 percent are elementary. About one-third of the elementary teachers are

TABLE III

AREA MOST CLOSELY ASSOCIATED

	Science		Math		Language Arts		Social Studies		Industrial and Vocational		Humanities	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Question Number 12												
	753	(37.6)	264	(13.2)	606	(30.3)	368	(18.4)	170	(3.5)	142	(7.1)
Question Number 19. How did they learn of the course												
Public notice	290	(38.5)	118	(44.7)	214	(35.3)	151	(41.0)	64	(37.6)	56	(39.4)
Instructor	151	(20.1)	46	(17.4)	152	(25.1)	61	(16.6)	43	(25.3)	28	(19.7)
Associates	139	(18.5)	67	(25.4)	154	(25.4)	104	(28.3)	37	(21.8)	43	(30.3)
Administrator	168	(22.3)	38	(14.4)	88	(14.5)	47	(12.8)	20	(11.8)	15	(10.6)
Question Number 23. Which should NASA emphasize to teachers?												
Materials	188	(25.0)	65	(24.6)	123	(20.3)	87	(23.6)	30	(17.6)	29	(20.4)
Activities	404	(53.7)	153	(58.0)	346	(57.1)	191	(51.9)	73	(42.9)	87	(61.3)
People	157	(20.8)	67	(25.4)	145	(23.9)	99	(25.9)	44	(25.9)	23	(23.2)

TABLE IV

LEVEL OF EDUCATION VERSUS MATERIALS

	Elementary		Junior High		Senior High		College	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Question Number 13. Level of education most closely associated								
	1,238	(61.8)	378	(18.9)	309	(15.4)	53	(2.6)
Question Number 8. NASA materials most valuable								
Publications	536	(43.3)	169	(44.7)	151	(48.9)	20	(27.7)
Films	681	(55.0)	201	(53.2)	153	(49.5)	33	(62.3)
Question Number 12. Area most closely associated								
Science	426	(34.4)	187	(49.5)	120	(38.8)	22	(41.5)
Math	150	(12.1)	69	(18.3)	39	(12.6)	5	(9.4)
Language Arts	521	(42.1)	11	(11.6)	33	(10.7)	6	(11.3)
Industrial and Vocational	37	(3.0)	37	(9.8)	72	(23.3)	12	(22.6)
Social Studies	276	(22.3)	50	(13.2)	31	(10.0)	8	(15.1)
Humanities	96	(7.8)	19	(5.0)	21	(6.8)	5	(9.4)

science-oriented as compared to nearly one-half of the junior high participants.

Years of Service to Education

Teaching experience is shown in Table V in comparison to the primary reasons for the participants taking the workshop. It is noticeable that the teachers with one to five years teaching experience list graduate credit as the main purpose for attending a workshop while those with more teaching experience list proficiency in the subject as their major motivation for taking the course.

Degrees

The degrees held by the workshop participants are here compared to the purposes for taking the workshop. These data are from the first questionnaire. (See Table VI.)

Those with associate degrees had "undergraduate credit" as the greater reason for taking the course. All other persons indicated "proficiency in the subject" as their main purpose in taking the course. The associate degrees were concentrated in elementary education. Since elementary education held 61 percent of the workshop participants; it also held the most number of Bachelor, Master and Doctoral degrees.

Role in the System

The role of the educator in the school system in shown in Table VII compared to size of the school districts. Educators from the small school districts of one to five schools dominate the scene at workshops. The large school systems of over 20 are the largest group following

TABLE V

YEARS OF SERVICE VERSUS PURPOSE OF ATTENDING A WORKSHOP
(second questionnaire)

	Zero	1 to 5 years	6 to 10 years	11 to 15 years	16 to 20 years	21 to 25 years	Over 25 years
Question Number 8. Years of service to education							
	22 (9.0)	87 (25.5)	38 (15.5)	37 (15.1)	24 (9.8)	10 (4.1)	24 (9.8)
Question Number 13. Purpose for attending the workshop							
Undergraduate credit	19 (86.4)	8 (9.2)	2 (5.3)	55 (13.5)	2 (8.3)	2 (20.0)	1 (4.2)
Graduate credit	2 (9.1)	45 (51.7)	17 (44.7)	8 (21.6)	5 (20.8)	2 (20.0)	6 (25.0)
Recertification	None (12.6)	11 (12.6)	1 (2.6)	2 (5.4)	4 (16.7)	1 (10.0)	2 (8.3)
Salary	None	14 (16.1)	4 (10.5)	8 (21.6)	1 (4.2)	None	1 (4.2)
Proficiency	1 (4.5)	30 (34.5)	19 (50.0)	20 (54.1)	14 (58.3)	7 (70.0)	13 (54.2)
Other	None	5 (5.7)	2 (5.3)	2 (5.4)	None	None	2 (8.3)

TABLE VI

COMPARISON OF DEGREES HELD WITH PURPOSE FOR TAKING THE WORKSHOP

	Associate		Bachelor		Master		Doctoral	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Question Number 29. Purpose for taking the workshop								
Undergraduate credit	118	(58.4)	146	(12.1)	6	(1.3)	3	(13.6)
Recertification	16	(7.9)	188	(15.6)	30	(6.4)	2	(9.1)
Graduate credit	18	(8.9)	262	(21.7)	88	(18.8)	2	(9.1)
Proficiency	33	(16.3)	489	(40.6)	260	(55.4)	11	(50.0)
Salary	6	(3.0)	158	(13.1)	95	(20.3)	1	(4.5)
Question Number 16. Highest degree or equivalent								
	202	(10.1)	1,205	(60.2)	469	(23.4)	22	(1.1)
Question Number 13. Professional level								
Elementary	167	(82.7)	775	(64.3)	234	(49.9)	9	(40.9)
Junior High	10	(5.0)	247	(20.5)	106	(22.6)	3	(13.6)
Senior High	13	(6.4)	167	(13.9)	115	(24.5)	3	(13.6)
College	2	(1.0)	17	(1.4)	24	(5.1)	7	(31.8)

TABLE VII

COMPARISON OF PROFESSIONAL ROLE TO DISTRICT SIZE

	Teacher		Administrator		Supervisor		Administrative Teacher		Other	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Question Number 28. Role in the system (first questionnaire)										
	1,669	(83.3)	55	(2.7)	18	(00.9)	69	(3.4)	152	(7.6)
Question Number 15. Number of schools in the district										
1 to 5	693	(41.5)	7	(38.9)	9	(50.0)	30	(43.5)	39	(25.7)
6 to 10	267	(16.0)	5	(27.8)	4	(22.2)	15	(21.7)	15	(9.9)
11 to 20	198	(11.9)	1	(5.6)	None		4	(5.8)	7	(4.6)
Over 20	417	(25.0)	3	(16.7)	3	(16.7)	14	(20.3)	11	(7.2)

those from the smallest districts.

Size of School Districts Represented in the Workshop

Size of the school district compared to the number of persons exposed to NASA's Spacemobile prior to the workshop is shown in Table VIII. Here again, the small school districts from one to five schools are shown to dominate the workshop scene. The participants from the small school districts also indicate that a larger percentage of them have had prior exposure to the NASA Spacemobile in their schools.

Public Schools or Private Schools

Not considered in the first questionnaire was the question of private school personnel participating in workshops. Table IX distinguishes numbers of public and private school persons who represented the different levels of educators in aerospace workshops.

Most of the workshop participants are educators in public schools. Of those in private schools, nearly an equal number are represented from both elementary and junior high school. Some teachers in parochial schools listed both elementary and junior high as their teaching level, which accounts for the total for that category to exceed 100 percent. Of those who listed "other," two were in government overseas schools.

Adequate Materials in Their School

The question usually comes up when discussing the equipment of schools whether the larger or smaller school district is better equipped on the average. The material or equipment here concerns aerospace

TABLE VIII

DISTRICT SIZE COMPARED TO SPACEMOBILE EXPOSURE

	1 to 5		6 to 10		11 to 20		Over 20	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Question Number 15. Number of schools in the district								
	795	(39.7)	311	(15.5)	224	(11.2)	460	(23.0)
Question Number 24. Have you seen a Spacemobile in your school?								
Yes	222	(27.9)	67	(21.5)	35	(15.6)	101	(22.0)
No	552	(69.4)	235	(75.6)	186	(83.0)	347	(75.4)
Missed it	16	(2.0)	5	(1.6)	3	(1.3)	10	(2.2)

TABLE IX

PUBLIC INSTITUTIONS OR PRIVATE
(second questionnaire)

	Public		Private		Parochial		Other	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Question Number 10. Public institutions or private (second questionnaire)								
	204	(83.3)	None		21	(8.6)	3	(1.2)
Question Number 4. Educational levels of workshop participants								
Elementary	119	(58.3)	None		14	(66.7)	None	
Junior High	49	(24.0)	None		12	(57.1)	1	(33.3)
Senior High	52	(25.5)	None		None		None	
Junior college	6	(2.9)	None		None		None	
College	5	(2.5)	None		None		2	(66.7)

education and would not necessarily pertain to materials in the classroom. (See Table X.)

It appears that perhaps the participants from small school districts consider their schools are better equipped than do those from larger districts. Overall, however, the majority of participants consider their schools do not have adequate aerospace materials.

Prior Workshop Experience

Table XI compares prior workshop attendance with the opinions of available aerospace materials in the school. Only about one in 10 of workshop participants had taken an aerospace workshop before. Of those participants with prior workshop experience, though a majority considered their schools were poorly equipped, the percentage of their schools that were well equipped was nearly twice that of participants who had not attended a workshop before. Because of their small number, this may not be a real difference.

Description of the Workshops

Major Topics of the Workshops

The aerospace workshops, though they may have the same title, offer varying amounts of aeronautics and space science. Curriculum of the course depends largely on the contributors and, due to a shortage of space science educators, the space science realm has been slighted. Table XII shows topics of the workshops compared to length of workshops.

Both comparisons seem to indicate the longer the duration of the workshop, the more aeronautics is included in the course. Workshops

TABLE X

MATERIALS IN THE SCHOOL

	Yes		No		Some	
	Number	Percent	Number	Percent	Number	Percent
Question Number 39. Are adequate aerospace materials in the school?						
	213	(10.6)	1,104	(55.1)	524	(26.2)
Question Number 15. Number of schools in the district						
1 to 5	94	(44.1)	446	(40.4)	213	(40.6)
6 to 10	29	(13.6)	176	(15.9)	86	(16.4)
11 to 20	23	(10.8)	113	(10.2)	69	(13.2)
Over 20	44	(20.7)	285	(25.8)	116	(22.1)

TABLE XI

PRIOR WORKSHOP EXPERIENCE COMPARED TO AVAILABLE MATERIALS IN THE SCHOOL

	Yes		No	
	Number	Percent	Number	Percent
Question Number 3. Prior workshop experience				
	191	(11.5)	1,793	(89.5)
Question Number 39. Are adequate aerospace materials available in your school?				
Yes	34	(17.8)	178	(9.9)
No	101	(52.9)	994	(55.4)
Some	47	(24.6)	474	(26.4)

TABLE XII

TOPICS OF WORKSHOPS COMPARED TO THEIR DURATION

	Aeronautics		Space Science	
	Number	Percent	Number	Percent
Question Number 4. Major topic of the workshop is:				
	638	(31.9)	1,094	(54.6)
Question Number 18. Length of the workshop				
1 to 3 days	14	(2.2)	89	(8.1)
1 week	23	(3.6)	157	(14.4)
2 weeks	186	(29.2)	381	(34.8)
3 weeks or more	405	(63.5)	446	(40.8)

	1 to 3 days		1 week		2 weeks		3 weeks or more	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
	222	(11.1)	186	(9.3)	599	(29.9)	934	(46.6)
Question Number 4. Topics of the workshop								
Aeronautics	14	(6.3)	23	(12.4)	186	(31.1)	405	(43.4)
Space Science	89	(40.1)	157	(84.4)	381	(63.6)	446	(47.8)

of shorter duration leave some mystery as to what might be covered in an aerospace workshop other than aeronautics or space science. In longer workshops, there appears to be some overlap of aeronautics and space science.

Sponsors of the Workshops

Generally, aerospace education has been conducted through the colleges of education, but not entirely. There have been a number of cases where an aerospace segment has been a part of another course offered by other departments or schools. Table XIII compares the workshop sponsor with course entity. Most aerospace workshops are sponsored by college departments though college departments of education sponsor the majority of them. Other sponsors included nine industrial arts departments and four science departments other than physics.

Workshop Experiences Outside the Classroom

Many workshops offer a number of outside experiences for the teacher and others offer only a few. Table XIV shows the extent of activity outside the classroom on field trips and aircraft flight experience.

Interesting here is that the one- to three-day workshops sponsor considerably more field trips proportionately than do one-week workshops. Otherwise, the longer the workshop, the more field trips are offered. Aircraft flight experience as a part of the workshop appears to be proportional to the length of the workshop.

TABLE XIII

COURSE SPONSOR COMPARED TO COURSE ENTITY

	Local School Board		College Department of Education		College Department of Physics		College Department of Aeronautics		Other	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Question Number 14. Who offered the course?										
Course	15	(6.1)	157	(64.1)	20	(8.2)	22	(9.0)	15	(6.1)
Question Number 18. Was the workshop a complete course or segment of another?										
Segment	None		9	(5.7)	None		None		None	
Course	15	(100)	145	(92.4)	20	(100)	22	(100)	15	(100)

TABLE XIV

LENGTH OF THE WORKSHOP COMPARED TO OUTSIDE ACTIVITIES

	1 to 3 days		1 week		2 weeks		3 weeks	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Question Number 18. Length of the workshop								
	222	(11.1)	186	(9.3)	599	(29.9)	934	(46.6)
Question Number 6. Are field trips a part of the course?								
Yes	150	(67.6)	89	(47.8)	482	(80.5)	820	(87.8)
No	60	(27.0)	90	(48.4)	113	(18.9)	70	(7.5)
Question Number 5. Is an aircraft flight part of the course experience?								
Yes	13	(5.9)	25	(13.4)	278	(46.4)	602	(64.5)
No	125	(56.3)	158	(84.9)	321	(53.6)	296	(31.7)

Student Subsidy

A number of scholarships are given to aerospace workshop participants by aircraft companies, state aeronautics commissions, colleges, and others. Table XV compares subsidy to professional level and length of the workshop.

Subsidy for aerospace workshop attendance was received by less than one-half of the participants. More people indicated they received 100 percent subsidy than did any lesser portion. The greater number of subsidies were to workshop participants attending workshops two- and three-weeks in length.

NASA Participation in the Workshops

As this study is considering the participation of NASA in aerospace workshops, the remaining portion of the context evaluation will deal primarily with that participation. In Table XVI, comparisons are made concerning the length of NASA participation in the workshops with the length of the workshop.

Nearly half of the participation of NASA in workshops, according to participants, was two- or three-days in duration. Though half of the most brief NASA visits were to workshops three weeks or more in length, generally longer duration of NASA visits were in the longer workshops. An interesting figure to notice in Table XVI is how a number of workshop participants indicated NASA visited four or five days in workshops only one to three days in length.

TABLE XV

SUBSIDY
(second questionnaire)

	Zero		25 Percent		50 Percent		75 Percent		100 Percent	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Question Number 16. To what extent were you subsidized?										
	148	(60.4)	8	(3.3)	11	(4.5)	31	(12.7)	36	(14.7)
Question Number 4. Professional level										
Elementary	93	(62.8)	5	(62.5)	3	(27.3)	14	(45.2)	17	(47.2)
Junior High	33	(22.3)	4	(50.0)	5	(45.5)	10	(32.3)	9	(25.0)
Senior High	23	(15.5)	2	(25.5)	4	(36.4)	12	(38.7)	12	(33.3)
Junior College	4	(2.7)	None		1	(9.1)	1	(3.2)	1	(2.8)
College	7	(4.7)	None		None		1	(3.2)	2	(5.6)
Question Number 17. Length of the workshop										
1 to 3 days	6	(4.1)	1	(12.5)	None		1	(3.2)	3	(8.3)
1 week	20	(13.5)	1	(12.5)	None		1	(3.2)	4	(11.1)
2 weeks	47	(31.8)	2	(25.0)	5	(45.5)	4	(12.9)	9	(25.0)
3 weeks	31	(20.9)	1	(12.5)	4	(36.4)	18	(58.1)	19	(52.8)
4 weeks	29	(19.6)	None		2	(18.2)	4	(12.9)	1	(2.8)
6 weeks	12	(8.1)	2	(25.0)	None		3	(9.7)	None	
8 weeks	None		1	(12.5)	None		None		None	
Longer	None		None		None		None		None	

TABLE XVI

NASA PARTICIPATION COMPARED TO LENGTH OF WORKSHOP

	1 day or less		2 or 3 days		4 or 5 days		More than a week	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Question Number 21. Time NASA contributed to the workshop								
	188	(9.4)	906	(45.2)	527	(26.3)	306	(15.3)
Question Number 18. Length of the workshop								
1 to 3 days	11	(5.9)	189	(20.9)	17	(3.2)	2	(0.7)
1 week	8	(4.3)	52	(5.7)	111	(21.1)	6	(2.0)
2 weeks	63	(33.5)	272	(3.0)	114	(21.6)	142	(46.4)
3 weeks or more	94	(50.0)	378	(41.7)	279	(52.9)	154	(50.3)

Spacemobile Coverage

The Spacemobile program of NASA has been visiting schools throughout every state each year since 1961. Since that time, the space science lecturers accompanying the units have presented educational programs to over 15 million students.

Each year hundreds of schools request the Spacemobile program, stating that they have never had NASA present a program in their school. Table XVII compares Spacemobile coverage with the teaching level.

Of those workshop participants who had seen a Spacemobile program in their school, nearly half were in elementary schools. In reference to Table VIII again, the most Spacemobile visits to schools were made in small school districts.

The Process Evaluation

Process in this study refers to the involvement in the workshop program and the teaching techniques or other circumstances which promote interaction between workshop participants.

Pace of Workshops

The pace of workshop schedules is sometimes questioned. Table XVIII, from the second questionnaire, compares pace of the schedule with the length of the workshop and the opportunity of the participants to become well enough acquainted with fellow participants to discuss professional problems.

Most of the workshop participants consider the pace of the program appropriate. Criticisms in the pace of the workshops were surprisingly

TABLE XVII

SPACEMOBILE COVERAGE COMPARED TO TEACHING LEVEL

	Yes		No		Missed it	
	Number	Percent	Number	Percent	Number	Percent
Question Number 24. Had you seen a Spacemobile before?						
	473	(23.6)	1,472	(73.5)	39	(1.9)
Question Number 13. Level of education of your work						
Elementary	219	(46.3)	987	(67.1)	26	(66.7)
Junior High	129	(27.3)	238	(16.2)	6	(15.4)
Senior High	104	(22.0)	200	(13.6)	4	(10.3)
College	23	(4.9)	29	(2.0)	None	

TABLE XVIII

PACE OF THE WORKSHOPS
(second questionnaire)

	Too fast		Too slow		Erratic		Appropriate	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Question Number 19. The considered pace of the workshop was								
	22	(9.0)	6	(2.4)	20	(8.2)	193	(78.8)
Question Number 17. Length of the workshop								
1 to 3 days	None		5	(83.3)	None		10	(5.2)
1 week	4	(18.2)	1	(16.7)	2	(10.0)	19	(9.8)
2 weeks	2	(9.1)	None		6	(30.0)	59	(30.6)
3 weeks	10	(45.5)	None		9	(45.0	57	(29.5)
4 weeks	3	(13.6)	None		3	(15.0	30	(15.5)
6 weeks	3	(13.6)	None		None		12	(6.2)
8 weeks	None		None		None		1	(0.5)
Longer	None		None		None		None	
Question Number 22. Well acquainted for discussion								
Yes	16	(72.7)	None		8	(40.0)	110	(57.0)
Limited	4	(18.2)	4	(66.7)	10	(50.0)	69	(35.8)
No	2	(9.1)	2	(33.3)	2	(10.0)	16	(8.3)
Question Number 23. Social interaction compared to other courses								
More valuable	11	(50.0)	3	(50.0)	6	(30.0)	100	(51.8)
Little more	5	(22.7)	1	(16.7)	8	(40.0)	33	(17.1)
Same	5	(22.7)	1	(16.7)	4	(20.0)	49	(25.4)
Less valuable	1	(4.5)	None		None		7	(3.6)
Much less	None		1	(16.7)	1	(5.0)	2	(1.0)

too slow in very short workshops and too fast in the two- and three-weeks workshops.

It appears that participants had a better chance to get acquainted in workshops where the pace was considered too fast than where it was too slow. Social interaction appears to be much the same in workshops where the pace was too slow or appropriate. However, where the pace of the workshop program was erratic, the social interaction appeared to be less valuable.

On Campus Housing

The advantages of housing workshop participants together are often a point concerning the value of a workshop. Table XIX compares participant housing to the value of acquaintances and social interaction of the participant.

Approximately one-fourth of the workshop participants were housed on campus and, of these, a much greater percent indicated they considered the social interaction involved in the course as more valuable than experienced in other courses.

Subgroups

Many workshops divide the participants up into subgroups to work on problem areas. In Table XX are comparisons between the size of the subgroups and the amount of professional acquaintance, extent of social interaction, and the amount of new material the teachers were able to incorporate in their teaching the following year.

In looking at the percentages of those groups of workshop participants who indicated they became well enough acquainted to discuss

TABLE XIX

HOUSING COMPARED TO VALUE OF ACQUAINTANCE AND SOCIAL INTERACTION

	Yes		No	
	Number	Percent	Number	Percent
Question Number 20. Were you housed with other participants?				
	60	(24.5)	181	(73.9)
Question Number 22. Professionally well acquainted				
Yes	41	(68.3)	94	(51.9)
Limited	18	(30.0)	68	(37.6)
No	1	(1.7)	20	(11.0)
Question Number 23. Social interaction compared to other courses				
More valuable	47	(78.3)	76	(42.0)
Little more	3	(5.0)	42	(23.0)
Same	7	(11.7)	52	(28.7)
Less valuable	2	(3.3)	5	(2.8)
Much less	None		4	(2.2)

TABLE XX

COMPARISON OF SUBGROUPING TO PROFESSIONAL ACQUAINTANCE, SOCIAL INTERACTION AND INCREASE IN TEACHING CAPABILITY
(second questionnaire)

	Yes--10		Yes--15		Yes--20		No	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Question Number 21. Did you work in subgroups?								
	75	(30.6)	17	(6.9)	42	(17.1)	105	(42.9)
Question Number 22. Did you become professionally acquainted?								
Yes	56	(74.7)	9	(52.9)	19	(45.2)	47	(44.8)
Limited	17	(22.7)	5	(29.4)	19	(45.2)	47	(44.8)
No	3	(4.0)	3	(17.6)	5	(11.9)	11	(10.5)
Question Number 23. Value of social interaction								
More valuable	46	(61.3)	11	(64.7)	21	(50.0)	40	(38.1)
Little more	18	(24.0)	2	(11.8)	9	(21.4)	18	(17.1)
Same	9	(12.0)	3	(17.6)	9	(21.4)	38	(36.2)
Little less	1	(1.3)	None		3	(7.1)	4	(3.8)
Much less	None		None		None		4	(3.8)
Question Number 37. New techniques and activities incorporated in teaching								
None	10	(13.3)	3	(17.6)	6	(14.3)	18	(17.1)
1 to 5	37	(49.3)	7	(41.2)	14	(33.3)	53	(50.5)
6 to 15	19	(25.3)	4	(23.5)	12	(28.6)	23	(21.9)
16 to 25	3	(4.0)	None		2	(4.8)	1	(1.0)
Over 25	2	(2.7)	2	(11.8)	4	(9.5)	1	(1.0)

professional problems, there seems to be an increase in acquaintance in direct proportion to the smaller size of subgroups. Social interaction also appears to be related to the size of the subgroups the workshop participants work in. The adoption of new teaching techniques and activities from workshop experiences to the classroom seems to be less closely related to the workshop participants having worked in subgroups.

Product Evaluation

The product evaluation is taken almost entirely from questions of the second questionnaire which had been sent to the educators approximately six months after the aerospace workshop. Knowing the product of an aerospace workshop experience could be measured in many ways; it is intended here to present some idea as to the effectiveness of NASA, the professional growth of the educator due to the workshop experience, community awareness increased by the workshop experience, and the preferences of the educators in future workshops.

Effectiveness of NASA Participation in Workshops

The duration of the Spacemobile visits of NASA vary according to type and length of the workshop. If the workshop is a lecture series type and only a few days long, the visit would probably only be a short one. Longer NASA visits are usually to workshops involving the teachers in activities being two or more weeks in length.

Table XXI concerns the length of NASA visits to workshops. It also concerns preferred duration by the participants and the opinion of the participants of the NASA presentations.

TABLE XXI

DURATION OF SPACEMOBILE VISITS TO AEROSPACE WORKSHOPS

	1 day or less		2 or 3 days		4 or 5 days		1 week or more	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Question Number 53. Duration of NASA's workshop visit								
	37	(14.1)	101	(41.2)	61	(24.9)	42	(17.1)
Question Number 54. Duration of NASA preferred by participants								
Longer	27	(73.0)	51	(50.5)	25	(41.0)	18	(42.9)
Shorter	None		3	(3.0)	2	(3.3)	None	
Same	10	(27.9)	46	(45.5)	32	(52.5)	24	(57.1)
Question Number 55. Participants' rating of NASA presentation								
Too simple	1	(2.7)	4	(4.0)	1	(1.6)	None	
Too difficult	2	(5.4)	1	(1.0)	4	(6.6)	2	(4.8)
Appropriate	33	(93.2)	95	(94.1)	44	(90.2)	40	(95.2)
Question Number 57. Quantity of NASA information adaptable to students								
None	5	(13.5)	12	(11.9)	6	(9.8)	None	
One-fourth	9	(24.3)	25	(24.8)	18	(29.5)	9	(21.4)
One-half	8	(21.6)	27	(26.7)	16	(26.2)	8	(19.0)
Three-fourths	3	(3.1)	8	(7.9)	6	(9.8)	5	(11.9)
Most	11	(29.7)	27	(26.7)	13	(21.3)	17	(40.5)

Workshop participants of workshops where the duration of visiting of NASA was one day or less indicated they would have wanted a longer exposure to NASA than did participants where NASA did visit longer. The rating of NASA presentations remained about the same, 90 percent appropriate, in each category of duration time NASA spent at workshops. The quantity of NASA information adaptable to the classroom appears to be similar for different durations of NASA visits to workshops, except where the duration is over a week. Where the duration of NASA visits are longest, a considerable higher percentage of the participants list "most" of the NASA information is adaptable to the classroom.

Usefulness of NASA Materials

The usefulness of NASA materials to teachers is a question which is usually answered entirely by opinion. The differences in answers have necessarily been taken with the consideration of their source, as do those of this report.

Table XXII compares the workshop participants' opinions after they have had the opportunity to apply their workshop experience to the classroom. The consideration of the educators of the amount of NASA information they believe adaptable to the learning experiences of students is the factor with which others are compared in this table.

Basically, the workshop participants considered over 60 percent of the NASA material as adaptable. Where participants considered more of the NASA information as adaptable to the classroom, they indicated a greater value to publications as value as teaching aids.

Workshop participants who indicated "most" of the information was adaptable to classroom use also listed a greater percentage of them

TABLE XXII

ADAPTABILITY OF NASA INFORMATION TO THE CLASSROOM

	None		1/4		1/2		3/4		Most	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Question Number 57. How much NASA information is adaptable to the classroom?										
	24	(9.8)	61	(24.9)	59	(24.1)	23	(9.4)	68	(27.8)
Question Number 4. Level of educational position										
Elementary	11	(45.8)	38	(62.3)	34	(57.6)	15	(65.2)	40	(58.8)
Junior High	3	(12.5)	13	(21.3)	20	(33.9)	7	(30.4)	20	(29.4)
Senior High	6	(24.0)	13	(21.3)	12	(20.3)	3	(13.0)	18	(26.5)
Junior college	2	(8.3)	1	(1.6)	None		1	(4.3)	3	(4.4)
College	2	(8.3)	1	(1.6)	2	(3.4)	1	(4.3)	3	(4.4)
Question Number 61. Which NASA materials are of most value?										
Publications	6	(25.0)	15	(24.6)	20	(33.9)	8	(34.8)	24	(35.3)
Films	17	(70.8)	44	(72.1)	37	(62.7)	15	(65.2)	47	(69.1)

TABLE XXII (continued)

	None		1/4		1/2		3/4		Most	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Question Number 62. Educators evaluate NASA materials as:										
Too technical	7	(29.2)	18	(29.5)	9	(15.3)	2	(8.7)	1	(1.5)
Informative	10	(41.7)	22	(36.1)	33	(55.9)	10	(43.5)	41	(60.3)
Motivative	7	(29.2)	23	(37.7)	29	(49.2)	14	(65.2)	29	(42.6)
Not specific	3	(12.5)	None		None		None		2	(2.9)
Question Number 59. Which service should NASA emphasize?										
Publications	1	(4.2)	5	(8.2)	16	(27.1)	8	(34.8)	8	(11.8)
Films	12	(50.0)	15	(24.6)	18	(30.5)	7	(30.4)	14	(20.6)
Space-mobile	7	(29.2)	25	(41.0)	29	(49.2)	12	(52.2)	27	(39.7)
Scientists	4	(16.7)	11	(18.0)	19	(32.2)	6	(26.1)	13	(19.1)
Activities	8	(33.3)	27	(44.3)	32	(54.2)	13	(56.5)	32	(47.1)
Other	None		1	(1.6)	1	(1.7)	1	(4.3)	1	(1.5)

TABLE XXII (continued)

	None		1/4		1/2		3/4		Most	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Question Number 37. How many new techniques have you included in class this year?										
None	5	(20.8)	4	(6.6)	13	(22.0)	6	(26.1)	9	(13.2)
1 to 5	14	(58.3)	40	(65.6)	23	(39.0)	5	(21.7)	30	(44.1)
6 to 15	3	(12.5)	13	(21.3)	18	(30.5)	8	(34.8)	16	(23.5)
16 to 25	None		1	(1.6)	2	(3.4)	1	(4.3)	4	(5.9)
Over 25	1	(4.2)	1	(1.6)	1	(1.7)	2	(8.7)	4	(5.9)
Question Number 51. Requested NASA materials since the workshop										
Films	None		6	(9.8)	5	(8.5)	2	(8.7)	5	(7.4)
Publications	2	(8.3)	16	(26.2)	17	(28.8)	8	(34.8)	23	(33.8)
Both	3	(12.5)	8	(13.1)	13	(22.0)	7	(30.4)	20	(29.4)
Neither	18	(75.0)	30	(49.2)	27	(45.8)	6	(26.1)	24	(35.3)

were informational and motivational. As participants valued the NASA information from "none" to "most" in adaptability for classroom use, those listing "most" considered "activities" should be emphasized more in future workshops and films less. Those who indicated "none" considered films should be emphasized more than activities.

Interestingly enough, a considerable number of the participants who considered none of the NASA information useful in the classroom found techniques and experiences of the workshop useful in the classroom. The highest percentage of new innovations in the classroom were indicated by participants who had considered "1/4" and "1/2" of the NASA information as useful.

Of those workshop participants who indicated a greater percentage of the NASA information and material as adaptable to the classroom, a larger percentage had requested materials from NASA. Publication requests appear to have been greater than film requests.

Applicability of NASA Activities

Activities or the learning situations which require the physical participation of the students in the learning situation are presented as a part of NASA workshop presentations. The effectiveness of these activities associated with space science concepts in the classroom is sometimes in question. Table XXIII compares the opinions of the former workshop participants of their NASA workshop activities with teaching techniques they have incorporated in their teaching.

Noticeable is that most of the workshop participants considered the activities conducted by NASA in the workshops as adaptable for use in the classroom, and nearly half of them have used from one to five

TABLE XXIII

APPLICABILITY OF ACTIVITIES

	Yes		No	
	Number	Percent	Number	Percent
Question Number 56. Suitability of NASA activities for the classroom				
	185	(75.5)	38	(15.5)
Question Number 37. New activities and techniques used in the classroom				
None	26	(14.1)	8	(21.1)
1-5	89	(48.1)	22	(57.9)
6-15	48	(25.9)	6	(15.8)
16-25	8	(4.3)	None	
Over 25	8	(4.3)	1	(2.6)
Question Number 30. Did you have an opportunity to participate in workshop activities?				
No	15	(8.1)	9	(23.7)
Some	108	(58.4)	21	(55.3)
Most	60	(32.4)	8	(21.1)

activities in the classroom as a result of the workshop experience. Participation in workshop activities appears to make a difference in the percentage of teachers who consider "most" of the NASA activities as suitable for the classroom.

Participant Attitudes Toward Future Aerospace Workshops

The enthusiasm for past courses often dims as the workshop participant returns to the classroom. Table XXIV compares the opinions of the educators of future workshops while they were in the workshop to those same opinions six months later.

When a random sampling of the original group of workshop participants were polled, the second questionnaire indicated nearly the same percentage of participants would take an advanced course. The participants' consideration of the percentage of fellow teachers that take a similar course fell from nearly 90 percent to about 70 percent.

The opinions of former workshop participants of preferred length of a workshop were primarily two weeks, followed by three weeks and by four weeks. There appeared to be an interest in the shorter workshops on the first questionnaire, but this was apparently lost as the teachers returned to their classrooms. "Early summer" was the choice of most suitable time for a workshop by considerable margin over the second choice of midsummer.

Professional Growth

Professional growth or the increased capability to perform in a profession is often difficult to measure other than by the transcript.

TABLE XXIV

ATTITUDES TOWARD FUTURE WORKSHOPS DURING AND SIX MONTHS FOLLOWING WORKSHOP PARTICIPATION

	During the workshop (first questionnaire)		Six months later (second questionnaire)	
	Number	Percent	Number	Percent
Would you take a more advanced course?				
Question	9.		33.	
Yes	1,529	(76.3)	186	(75.9)
No	440	(22.0)	50	(24.4)
Would teachers take such a course in your district?				
Question	10.		32.	
Yes	1,797	(89.7)	171	(69.8)
No	175	(8.7)	51	(20.8)
How long should such a program be?				
Question	11.		27.	
0 to 15 hours	591	(29.5)		
16 to 30 hours	798	(39.8)		
31 to 45 hours	577	(28.8)		

TABLE XXIV (continued)

	During the workshop (first questionnaire)		Six months later (second questionnaire)	
	Number	Percent	Number	Percent
1 week			11	(4.5)
2 weeks			86	(35.1)
3 weeks			69	(28.2)
4 weeks			52	(21.2)
6 weeks			25	(10.2)
8 weeks			4	(1.6)
Other			1	(0.4)
When is the most suitable time for workshops? Question 15.				
Early summer			109	(44.5)
Midsummer			73	(29.8)
Late summer			63	(25.7)
During school			7	(2.9)
Other			1	(0.4)

Table XXV compares the duration of NASA participation to answers of several questions pertaining to professional growth.

Though the percentages of new innovations were much the same for each category of duration that NASA visited workshops, the percentage of those indicating "none" appeared to decline in percentage in proportion to longer NASA participation. The percentages of educators who indicated an increased capability to help students in class appeared to increase in proportion to the length of the visit of NASA to the workshop. Percentages of educators who indicated an increased capability to assist students with extracurricular activities also increased with the length of the visit of NASA to the workshops.

The percentages of those workshop participants who became resource persons to their faculties increased in proportion to the length of the visit to the workshop by NASA. Teacher-community participation appears to be an area that is very little affected, even by longer duration in the workshop. Although the workshop participants' awareness of aerospace developments is sharpened due to attending even the shortest aerospace workshop, there appears to be a relationship between increased awareness and the length of NASA visits to the workshops.

Analysis of Chi Square Tables

The chi square formula for determining the significance and contingency coefficients of the relationships in hypothesis of this study is from Nonparametric Statistics for the Behavioral Sciences.

Concerning the possible relationship between the length of the workshop and the number of new techniques or activities included in the lesson plans of teachers, the following tables were constructed

TABLE XXV

NASA PARTICIPATION IN WORKSHOPS COMPARED TO PROFESSIONAL GROWTH

	1 day or less		2 or 3 days		4 or 5 days		A week or more	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Question Number 53. Time NASA contributed to workshops								
	37	(15.1)	101	(41.2)	61	(24.9)	42	(17.1)
Question Number 37. New teaching techniques from workshop experience								
None	10	(27.0)	19	(18.8)	5	(8.2)	3	(7.1)
1 to 5	20	(54.1)	45	(44.6)	33	(54.1)	19	(45.2)
6 to 15	3	(8.1)	24	(23.8)	18	(29.5)	11	(26.2)
16 to 25	None		4	(4.0)	3	(4.9)	1	(2.4)
Over 25	2	(5.4)	3	(3.0)	1	(1.6)	3	(7.1)
Question Number 38. Increased capability of helping students with class projects								
Yes	25	(67.6)	74	(73.3)	51	(83.6)	37	(88.1)
Same	8	(21.6)	16	(15.8)	7	(11.5)	None	
No	2	(5.4)	5	(5.0)	2	(3.3)	1	(2.4)

TABLE XXV (continued)

	1 day or less		2 or 3 days		4 or 5 days		A week or more	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Question Number 39. Increases capability of assisting with extracurricular activities?								
Yes	15	(40.5)	50	(49.5)	31	(50.8)	26	(61.9)
Same	7	(18.9)	26	(25.7)	16	(26.2)	7	(16.7)
No	12	(32.4)	17	(16.8)	12	(19.7)	5	(11.9)
Question Number 34. Have you been a resource person to the faculty?								
Talks	5	(13.5)	6	(5.9)	1	(1.6)	2	(4.8)
Resources	4	(10.8)	28	(27.7)	18	(29.5)	18	(42.9)
Both	1	(2.7)	13	(12.9)	7	(11.5)	7	(16.7)
No	26	(70.3)	56	(55.4)	34	(55.7)	15	(35.7)
Question Number 35. Have you participated in community activities?								
Yes	4	(10.8)	6	(5.9)	3	(4.9)	5	(11.9)
No	31	(83.8)	91	(90.1)	55	(90.2)	35	(83.3)
Question Number 36. Greater awareness of aerospace developments								
Yes	33	(89.2)	95	(94.1)	57	(93.4)	42	(100.0)
No	3	(8.1)	6	(5.9)	3	(4.9)	None	

in connection with Hypothesis 1. (See Table XXVI.)

The null hypothesis of Hypothesis 1, which says there is no relationship between the length of the workshop and the number of techniques or activities the teacher includes in lesson plans as a result of workshop experience, is rejected. In consideration of Hypothesis 2, a possible relationship between NASA duration at workshops and numbers of techniques the teachers applied in the classroom, Table XXVII was constructed.

The null hypothesis of Hypothesis 2, which says there is no relationship between the duration of the NASA representation at aerospace workshops and the number of techniques or activities included in lesson plans as a result of the workshop experience, is accepted. In the statistical analysis of the possible relationship between the duration of time NASA visited a workshop and the availability the workshop participant made of themselves to their own faculties as resource persons, the basic data were first assembled into Table XXVIII.

The null hypothesis of Hypothesis 3, which states there is no relationship between duration of NASA's representation at aerospace workshops and the extent to which the workshop participant is of assistance to their faculty by talks or as a resource person, is rejected.

In comparing the workshop participants' experience of having worked in subgroups while taking the workshop to the number of new teaching techniques and activities incorporated in the lesson plans of the teachers, the results are shown in Table XXIX. The null hypothesis of Hypothesis 4, which says there is no relationship between the group dynamics of having the workshop participants work in subgroups and the number of techniques or activities the teacher includes in their lesson

TABLE XXVI

CHI SQUARE RELATIONSHIPS OF WORKSHOP LENGTH COMPARED TO NUMBERS OF TECHNIQUES OR ACTIVITIES INCLUDED IN THE CLASSROOM

Length of Workshop	Number of new techniques or activities* None Number	None Percent	1 to 5 Number	1 to 5 Percent	6 to 15 Number	6 to 15 Percent	16 to 25 Number	16 to 25 Percent	Over 25 Number	Over 25 Percent
1 to 3 days	1	(9.1)	6	(54.5)	2	(18.2)	1	(9.1)	1	(9.1)
1 week	2	(7.4)	19	(70.4)	5	(18.5)	1	(3.7)	None	
2 weeks	12	(17.4)	29	(42.0)	18	(26.1)	1	(1.4)	None	
3 weeks	9	(11.5)	40	(51.3)	21	(26.9)	None		3	(3.8)
4 weeks	7	(18.9)	12	(32.4)	9	(24.3)	3	(8.1)	3	(8.1)
6 weeks	4	(23.5)	7	(41.2)	1	(5.9)	2	(11.8)	1	(5.9)
8 weeks	1	(100.0)	None		None		None		None	
Longer	None		None		None		None		None	

	None	1 to 5	6 to 15	16 or over	Totals
1 day to 1 week					
Observed	3	25	7	3	38
(expected)	(6.16)	(19.34)	(9.59)	(2.91)	
2 to 3 weeks					
Observed	21	69	39	5	134
(expected)	(21.73)	(68.21)	(33.80)	(10.26)	
4 weeks or more					
Observed	12	19	10	9	50
(expected)	(8.11)	(25.45)	(12.61)	(3.83)	
Totals	36	113	56	17	222
Chi square					16.877
Degrees of freedom					6.0
Critical chi square at 0.05					12.59
Contingency coefficient					0.264
Probability					Less than 0.01

*In order to use the chi square formula more effectively, the table was condensed providing numbers greater than one in each cell.

TABLE XXVII

CHI SQUARE RELATIONSHIP OF DURATION OF NASA AT AEROSPACE WORKSHOPS COMPARED TO NEW TEACHING TECHNIQUES AND ACTIVITIES INCLUDED IN LESSON PLANS FROM WORKSHOP EXPERIENCES

NASA Duration at Workshops	New techniques included in lesson plans									
	None		1 to 5		6 to 15		16 to 25		Over 25	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1 day or less	10	(27.0)	20	(54.1)	3	(8.1)	None		2	(5.4)
2 or 3 days	19	(18.8)	45	(44.6)	24	(23.8)	4	(4.0)	3	(3.0)
4 or 5 days	5	(8.2)	33	(54.1)	18	(29.5)	3	(4.9)	1	(1.6)
A week or more	3	(7.1)	19	(45.2)	11	(26.2)	1	(2.4)	3	(7.1)

				16 or more	Totals*
1 day or less					
Observed	10	20	3	2	35
(expected)	(5.7)	(18.04)	(8.63)	(2.62)	
2 to 3 days					
Observed	19	45	24	7	95
(expected)	(15.48)	(48.96)	(23.44)	(7.11)	
4 to 5 days					
Observed	5	33	18	4	60
(expected)	(9.78)	(30.93)	(14.80)	(4.49)	
Week or longer					
Observed	3	19	11	4	37
(expected)	(6.03)	(19.07)	(9.13)	(2.77)	
Totals	37	117	56	17	227
Chi Square					14.076
Degrees of freedom					9
Critical chi square at 0.05					16.92
Contingency coefficient					0.240
Probability				Greater than	.10

*To determine if a relationship should exist, columns at the right side of the table were combined.

TABLE XXVIII

CHI SQUARE RELATIONSHIP OF NASA DURATION AT WORKSHOPS TO TEACHERS BECOMING RESOURCE PERSONS TO THEIR FACULTIES

Resource Availability to Faculty	NASA duration at workshops* 1 day or less Number	Per cent	2 to 3 days Number	Per cent	4 to 5 days Number	Per cent	1 week or more Number	Per cent
Talks	5	(13.5)	6	(5.9)	1	(1.6)	2	(4.8)
Resources	4	(10.8)	28	(27.7)	18	(29.5)	18	(42.9)
Both	1	(2.7)	13	(12.9)	7	(11.5)	7	(16.7)
No	26	(70.3)	56	(55.4)	34	(55.7)	15	(35.7)

Duration of NASA visit to workshops	Resource assistance to faculty: Were resource persons	Were not resource persons	Totals
1 day or less			
Observed	10	26	36
(expected)	(16.43)	(19.57)	
2 to 3 days			
Observed	47	56	103
(expected)	(47.01)	(55.99)	
4 to 5 days			
Observed	26	34	60
(expected)	(27.39)	(32.61)	
1 week or more			
Observed	27	15	42
(expected)	(19.17)	(22.83)	
Totals	110	131	241
Chi square			10.64
Degrees of freedom			3.0
Critical chi square at 0.05			7.82
Contingency coefficient			0.204
Probability			Less than 0.02

*To determine the possible chi square relationship of Table XXVIII, the first three rows, or positive responses, were combined to produce the table.

TABLE XXIX

CHI SQUARE RELATIONSHIPS OF SUBGROUP PARTICIPATION IN WORKSHOPS TO THE NUMBER OF NEW TECHNIQUES AND ACTIVITIES INCORPORATED IN TEACHING

Techniques and Activities	Subgroup experience* Yes--10 Number	Yes--10 Percent	Yes--15 Number	Yes--15 Percent	Yes--20 Number	Yes--20 Percent	No Number	No Percent
None	10	(13.3)	3	(17.6)	6	(14.3)	18	(17.1)
1 to 5	37	(49.3)	7	(41.2)	14	(33.3)	53	(50.5)
6 to 15	19	(25.3)	4	(23.5)	12	(28.6)	23	(21.9)
16 to 25	3	(4.0)	None		2	(4.8)	1	(1.0)
Over 25	2	(2.7)	2	(11.8)	4	(9.5)	1	(1.0)

	Subgroup experience Subgroups	No subgroups	Totals
None Observed	19	18	37
(expected)	(20.93)	(16.07)	
1 to 5 Observed	58	53	111
(expected)	(62.78)	(48.22)	
6 to 15 Observed	35	23	58
(expected)	(32.81)	(25.19)	
16 and over Observed	13	2	15
(expected)	(8.48)	(6.52)	
Totals	125	96	221
Chi square			7.122
Degrees of freedom			3.0
Critical chi square at 0.05			7.82
Contingency coefficient			0.176
Probability		Greater than	0.05

*This table was condensed to include all yes columns together in comparison against the no column.

plans as a result of the workshop experience, is accepted.

Summary of Findings

The analysis of the follow-up questionnaire shows that there was a significant relationship at 0.01 level of confidence between the length of the workshop and the number of activities the teacher included in lesson plans. The null hypothesis of no significant difference between these relationships was rejected.

There is no significant relationship at the 0.05 level of confidence between the duration of the NASA representation at aerospace workshops and the number of activities teachers include in their lesson plans. The null hypothesis of no significant difference between the above relationships was accepted.

There is a significant relationship at the 0.02 level of confidence between the duration of the representation of NASA at aerospace workshops and the extent to which workshop participants are of assistance to their faculties by talks or as resource persons. The null hypothesis of no significant difference between these two was rejected,

Lastly, there is no significant relationship at 0.05 level of confidence between the group dynamics of having the workshop participants work in subgroups and the number of techniques or activities the teacher includes in their lesson plans as a result of the workshop. The null hypothesis that states the above is accepted.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

In accordance with the purpose of the study, a questionnaire was developed. This questionnaire was then given to 2,007 aerospace workshop participants. The responses to this questionnaire were used in describing the workshop participants, the workshop itself, and NASA's role at these workshops.

A second questionnaire was then developed. This was mailed to a random sampling of 500 former workshop participants in February, 1971. The responses on this questionnaire were used to detect significant differences between relationship of length of the workshop to the number of activities teachers included in their lesson plans, the length of NASA's duration at the workshop and the number of activities teachers included in their lesson plans, the duration of NASA's representation to aerospace workshop and the extent to which workshop participants were of assistance to their faculty, and the group dynamics of having the workshop participants work in subgroups and the number of techniques they included in their lesson plans.

The instrument used in this study was developed by the investigator. The subjects for this study were participants in aerospace workshops in the summer of 1970.

Basically, the design of the study was for all aerospace workshop participants to answer the first questionnaire. The following February, a random sample of 500 former workshop participants would answer a second questionnaire.

The hypotheses listed in this study are:

1. There is no relationship between the length of the workshop and the number of techniques or activities the teacher includes in lesson plans as a result of the workshop experience.

2. There is no relationship between the duration of the NASA representation at aerospace workshops and the number of techniques or activities included in lesson plans as a result of the workshop experience.

3. There is no relationship between the duration of NASA representation at aerospace workshops and the extent to which the workshop participants are of assistance to their faculties by talks or as resource persons.

4. There is no relationship between the group dynamics of having the workshop participants work in subgroups and the number of techniques or activities the teacher includes in their lesson plans as a result of the workshop experience.

Conclusions

From the data of Table XXVI, the chi square was computed to determine the relationship between workshop length and the number of techniques or activities the teachers had included in lesson plans as a result of the aerospace workshop experience. An obtained chi square of 16.877 was found. In comparing this to the critical chi square at the

0.05 level, which was 12.95, resulted in the conclusion that this value was significant. Thus, the contingency coefficient of 0.246 was considered to reflect a significant relationship.

In Table XXVII are data that were used in figuring the chi square to determine the relationship between the duration of NASA visits to aerospace workshops with the number of new teaching activities and techniques teachers incorporate into their classes due to their workshop experience. A chi square of 14.076 was calculated and compared to the critical chi square of 16.92 and was not seen to be significant at the 0.5 level. The contingency coefficient of 0.240 was calculated but as stated, was not a significant coefficient at the 0.05 level.

Though there does not appear to be a relationship between NASA duration and new techniques in the classroom at the 0.05 level, the data of Table XXVII and the correlation coefficient so indicated a positive relationship, though not as significant as the length of the workshops. The data of Table XXVIII were used to calculate the chi square in order to determine the relationship between the duration of NASA participation in workshops and the effectiveness of the teacher as an aerospace resource person to his faculty. A calculated chi square of 10.64 was determined and compared to the critical chi square of 7.82, thus determining there was a significant relationship.

The contingency coefficient was figured to be .204 and, in looking over the data in the first portion of Table XXVIII, it appears that there is a significant positive relationship at 0.05 between the duration of NASA at workshops and the envolvement of the teacher as a resource person to his faculty.

From the data of Table XXIX, the chi square was calculated to

determine if a significant relationship existed between the number of new techniques or activities a teacher includes in lesson plans due to having attended an aerospace workshop and that the teacher had participated in the workshop activities in a subgroup. The chi square was calculated to 7.122 and when compared to the critical chi square of 7.82, it was concluded there was no significant difference between the two at the 0.05 level. The contingency coefficient was 0.176.

In looking at the data of Table XXIX, however, the relationship, though it appears to be minor, is positive. The proportions of people having worked in subgroups increase from roughly a one to one ratio for subgroups and nonsubgroup people in the category of one to five, but increases to over six to one in favor of those having worked in subgroups in the category which includes over 16 new techniques in their teaching, thus defining a trend.

Recommendations

There are several recommendations concerning further study that have stemmed from this investigation. The following recommendations are intended to strengthen, as well as broaden, the scope of this study should further investigation of this type be contemplated.

Recommendations for strengthening a similar study would be as follows:

1. There should be more uniform administration procedures for the instruments. As the number of people involved in preparation and administration of the first questionnaire grew out of hand, the effectiveness of the project declined.

2. The questionnaire should be simple and easy to follow for quickness and a greater surety of answers. The first questionnaire of this study, due to printer assistance, became a quagmire losing time and data from over 20 workshops.

Recommendations for broadening the study are as follows:

1. The instrument of this study involved content belonging exclusively to aerospace workshops. In order to broaden a future study that might have associated objectives, workshops concerning other areas of study should be considered.

2. As the effectiveness of group dynamics was not dramatically displayed in this study, future studies might be designed to further interpret the values of group dynamics in workshops.

There are two recommendations, based on results of this study, that might be incorporated into aerospace workshops. They are as follows:

1. If the purpose of the workshop is to make the teacher a more effective resource person in the school system, then a longer duration of the NASA Educational Programs team is beneficial.

2. Should the purpose of the aerospace workshop be to induce the teacher to integrate more aerospace subject matter into lesson plans, then longer workshops are more effective.

Although there have been studies of workshops, no other studies of aerospace workshops were found. Therefore, this study became exploratory rather than a definitive piece of research.

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APPENDIX A

THE FIRST QUESTIONNAIRE

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		A	B	C	D	E	F
1.	Sex						
2.	Do you currently teach a unit concerning aerospace?						
3.	Have you attended an aerospace course before?						
4.	The majority of time in your course is consumed on the topic of:						
5.	Is an aircraft flight a part of your course experience?						
6.	Is a field trip part of your course?						
7.	Were the NASA representatives available to work with you for a sufficient length of time?						
8.	Which NASA materials are of most value as teaching aids?						
9.	Would you take a more advanced course in aerospace education?						
10.	Do you feel that teachers would attend a similar program if conducted in your district during the school year?						
1.	How long should such a program be?						
12.	In which area are you most closely associated?						

A	B	C	D	E	F		
						13.	In which level of education do you work?
						14.	Years of service in education?
						15.	How many schools, of the type where you teach, are in your school district?
						16.	What is your highest college degree or its equivalent?
						17.	How much college credit or its equivalent are you given for participation in this course?
						18.	What is the length of your course?
						19.	How did you learn about the course?
						20.	Not considering the course director, which contributed most to your understanding of aerospace and its implications for teaching?
						21.	How much time did NASA contribute to your course program?
						22.	Indicate the percentage of time spent on classroom activities.
						23.	Which area should NASA emphasize more to teachers?

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		A	B	C	D	E	F
24.	Have you ever seen a Spacemobile demonstration in a school?	☐	☐	☐			
25.	Do you anticipate teaching a course where the primary emphasis will be on the students understanding the basic concepts of aeronautics?	☐	☐	☐			
26.	Do you anticipate teaching a course where the primary emphasis will be on the students understanding the basic concepts of aerospace?	☐	☐	☐			
27.	Can you include topics from this course in your teaching?	☐	☐	☐			
28.	What is your role in the school?	☐	☐	☐	☐	☐	
29.	Are you taking this course primarily for:	☐	☐	☐	☐	☐	
30.	As a course experience, which of the following NASA Centers, if any, did you tour?	☐	☐	☐	☐	☐	☐
31.	As a course experience, which of the following NASA Centers, if any, did you tour?	☐	☐	☐	☐	☐	☐
32.	Which NASA subject area has been the most informative for future reference in classes?	☐	☐	☐	☐	☐	☐
33.	How much of the NASA information and activities can you adapt for learning experiences?	☐	☐	☐	☐		
34.	How would you evaluate the NASA materials used in the course?	☐	☐	☐	☐		
35.	Do you believe an understanding of basic aerospace concepts could be easily included in the subject you teach?	☐	☐	☐			

A	B	C	D	E	F		
☐	☐	☐				36.	Should the duration of NASA's participation in this course be:
☐	☐	☐				37.	How would you rate the content of NASA presentations?
☐	☐	☐				38.	Have the activities conducted by the NASA lectures been suitable for your use in school this next year?
☐	☐	☐				39.	Are adequate supplementary materials available in your school concerning aerospace education?

Answer Sheet

1. a. Male
   b. Female
2. a. Yes
   b. No
3. a. Yes
   b. No
4. a. Aeronautics
   b. Space Science
5. a. Yes
   b. No
6. a. Yes
   b. No
7. a. Yes
   b. No
8. a. Publications
   b. Films
9. a. Yes
   b. No
10. a. Yes
    b. No
11. a. 0 to 15 hours
    b. 16 to 30 hours
    c. 31 to 45 hours
12. a. Science
    b. Mathematics
    c. Language Arts
    d. Social Studies
    e. Industrial and Vocational
    f. Humanities
13. a. Elementary
    b. Junior High School
    c. Senior High School
    d. College
14. a. 0 to student teacher
    b. 1 to 5
    c. 6 to 10
    d. Over 10
15. a. 1 to 5
    b. 6 to 10
    c. 11 to 20
    d. Over 20
16. a. Associate
    b. Bachelor
    c. Master
    d. Doctoral

17. a. 1
    b. 2
    c. 3
    d. More then 3
18. a. 1 to 3 days
    b. 1 week
    c. 2 weeks
    d. 3 weeks or more
19. a. Published notice
    b. Announcement by instructor or advisor
    c. Teacher associates who have previously taken course
    d. Announcement by administrators
20. a. Aerospace industries
    b. The military
    c. NASA
    d. Other government agencies
21. a. One day or less
    b. Two or three days
    c. Four or five days
    d. More than a week
22. a. None
    b. Less than 25 percent
    c. Less than 50 percent
    d. More than 50 percent
23. a. Available materials
    b. Appropriate classroom activities
    c. Available resource people
24. a. Yes
    b. No
    c. It visited school but my class missed it
25. a. Yes
    b. No
    c. I would be interested
26. a. Yes
    b. No
    c. I would be interested
27. a. Yes
    b. No
    c. Only with supervisory consent
28. a. Teacher
    b. Administrator
    c. Supervisor
    d. Administrator/Teacher
    e. None of the above

29. a. Undergraduate credit
    b. Recertification credit
    c. A graduate degree
    d. Proficiency in subject
    e. Salary increment credit

30. a. KSC
    b. GSFC
    c. MSC
    d. LERC
    e. FRC
    f. More than one of the above

31. a. ARC
    b. LARC
    c. MSFC
    d. Wallops
    e. JPL
    f. More than one of the above

32. a. Manned space flight
    b. Aeronautics
    c. Future space exploration
    d. Application programs
    e. Scientific programs
    f. Benefits to mankind

33. a. 1/4
    b. 1/2
    c. 3/4
    d. Most

34. a. Too technical for many students
    b. Very good for student information
    c. Good for motivating student
    d. Not specific enough

35. a. Yes
    b. No
    c. Not necessarily

36. a. Longer
    b. Shorter
    c. Just as it is

37. a. Too simple
    b. Too difficult
    c. Appropriate

38. a. Yes
    b. No
    c. None were conducted

39. a. Yes
    b. No
    c. Some

APPENDIX B

RESULTS

First Questionnaire

1.	Sex		
	a. Male	739	36.9%
	b. Female	1,254	62.6%
2.	Do you currently teach a unit concerning aerospace?		
	a. Yes	581	29.0%
	b. No	1,425	71.1%
3.	Have you attended an aerospace course before?		
	a. Yes	191	9.5%
	b. No	1,793	89.5%
4.	The majority of time in your course is consumed on the topic of:		
	a. Aeronautics	638	31.9%
	b. Space Science	1,094	54.6%
5.	Is an aircraft flight a part of your course experience?		
	a. Yes	934	46.6%
	b. No	927	46.3%
6.	Is a field trip part of your course experience?		
	a. Yes	1,564	78.1%
	b. No	350	17.5%
7.	Were the NASA representatives available to work with you for a sufficient length of time?		
	a. Yes	1,501	74.9%
	b. No	432	21.6%
8.	Which NASA materials are of most value as teaching aids?		
	a. Publications	879	43.9%
	b. Films	1,078	53.8%

9.	Would you take a more advanced course in aerospace education?		
	a. Yes	1,529	76.3%
	b. No	440	22.0%
10.	Do you feel that teachers would attend a similar program if conducted in your district during the school year?		
	a. Yes	1,797	89.7%
	b. No	175	8.7%
11.	How long should such a program be?		
	a. 0 to 15 hours	591	29.5%
	b. 16 to 30 hours	798	39.8%
	c. 31 to 45 hours	577	28.8%
12.	In which area are you most closely associated:		
	a. Science	753	37.6%
	b. Mathematics	264	13.2%
	c. Language Arts	606	30.3%
	d. Social Studies	368	18.4%
	e. Industrial and Vocational	170	8.5%
	f. Humanities	142	7.1%
13.	In which level of education do you work?		
	a. Elementary	1,238	61.8%
	b. Junior High School	378	18.9%
	c. Senior High School	309	15.4%
	d. College	53	2.6%

14.	Years of service to education:		
	a. 0 to student teacher	240	12.0%
	b. 1 to 5	730	15.5%
	c. 6 to 10	361	18.0%
	d. Over 10	613	30.6%
15.	How many schools, of the type where you teach, are in your school district?		
	a. 1 to 5	795	39.7%
	b. 6 to 10	311	15.5%
	c. 11 to 20	224	11.2%
	d. Over 20	460	23.0%
16.	What is your highest college degree or its equivalent?		
	a. Associate's	202	10.1%
	b. Bachelor's	1,205	60.2%
	c. Master's	469	23.4%
	d. Doctoral	22	1.1%
17.	How much college credit or its equivalent are you given for participation in this course?		
	a. 1	252	12.6%
	b. 2	235	11.7%
	c. 3	938	46.8%
	d. More than 3	415	20.7%
18.	What is the length of your course?		
	a. 1 to 3 days	222	11.1%
	b. 1 week	186	9.3%
	c. 2 weeks	599	29.9%
	d. 3 weeks or more	934	46.6%

19.	How did you learn about the course?		
	a. Published notice	731	36.5%
	b. Announcement by instructor or advisor	449	22.4%
	c. Teacher associates who have previously taken the course	429	21.4%
	d. Announcement by administrators	339	16.9%
20.	Not considering the course director, which contribute most to your understanding of aerospace and its implications for teaching?		
	a. Aerospace industries	161	8.0%
	b. The military	194	9.7%
	c. NASA	1,528	76.3%
	d. Other government agencies	28	1.4%
21.	How much time did NASA contribute your course program?		
	a. One day or less	188	9.4%
	b. Two or three days	906	45.2%
	c. Four or five days	527	26.3%
	d. More than a week	306	15.3%
22.	Indicate the percentage of time spent on classroom activities.		
	a. None	113	5.6%
	b. Less than 25%	479	23.9%
	c. Less than 50%	473	23.6%
	d. More than 50%	845	42.2%
23.	Which area should NASA emphasize more to teachers?		
	a. Available materials	423	21.1%
	b. Appropriate classroom activities	1,067	53.3%
	c. Available resource people	448	22.4%

24. Have you ever seen a Spacemobile demonstration in a school?

a. Yes	473	23.6%
b. No	1,472	73.5%
c. It visited my school but my class missed it	39	1.9%

25. Do you anticipate teaching a course where the primary emphasis will be on the student's understanding of the basic concepts of aeronautics?

a. Yes	664	32.2%
b. No	884	44.1%
c. I would be interested	450	22.5%

26. Do you anticipate teaching a course where the primary emphasis will be on the students understanding the basic concepts of aerospace?

a. Yes	836	41.7%
b. No	638	31.9%
c. I would be interested	490	24.5%

27. Can you include topics from this course in your teaching?

a. Yes	1,827	91.2%
b. No	80	4.0%
c. Only with supervisory consent	26	1.3%

28. What is your role in the school?

a. Teacher	1,669	83.3%
b. Administrator	55	2.7%
c. Supervisor	18	0.9%
d. Administrator/Teacher	69	3.4%
e. None of the above	152	7.6%

29. Are you taking this course primarily for:

a. Undergraduate credit	325	16.2%
b. Recertification credit	242	12.1%
c. A graduate degree	380	19.0%
d. Proficiency in the subject	813	40.6%
e. Salary increment credit	267	13.3%

30. As a course experience, which of the following NASA Centers, if any, did you tour?

a. KSC	262	13.1%
b. GSFC	133	6.6%
c. MSC	88	4.4%
d. LERC	45	2.2%
e. FRC	9	0.4%
f. More than one of the above	88	4.4%

31. As a course experience, which of the following NASA Centers, if any, did you tour?

a. ARC	143	7.1%
b. LARC	19	0.9%
c. MSFC	91	4.5%
d. Wallops	23	1.1%
e. JPL	94	4.7%
f. More than one of the above	81	4.0%

32. Which NASA subject area has been the most informative for future reference in classes?

a. Manned Space Flight	619	30.9%
b. Aeronautics	184	9.2%
c. Future Space Exploration	392	19.6%
d. Application Programs	230	11.5%
e. Scientific Programs	161	8.0%
f. Benefits to Mankind	518	25.9%

33. How much of the NASA information and activities can you adapt for learning experiences?

a. 1/4	466	23.3%
b. 1/2	504	25.2%
c. 3/4	201	10.0%
d. Most	735	36.7%

34. How would you evaluate the NASA materials used in the course?

a. Too technical for many students	220	11.0%
b. Very good for student information	792	39.5%
c. Good for motivating students	931	46.5%
d. Not specific enough	39	1.9%

35. Do you believe an understanding of basic aerospace concepts could be easily included in the subject you teach?

a. Yes	1,582	79.0%
b. No	154	7.7%
c. Not necessarily	186	9.3%

36.	Should the duration of NASA's participation in this course be?		
	a. Longer	987	49.3%
	b. Shorter	65	3.2%
	c. Just as it is	838	41.8%
37.	How would you rate the content of NASA presentations?		
	a. Too simple	52	2.6%
	b. Too difficult	108	5.4%
	c. Appropriate	1,730	86.4%
38.	Have the activities conducted by NASA lecturers been suitable for your use in school this year?		
	a. Yes	1,607	80.2%
	b. No	153	7.6%
	c. None were conducted	78	3.9%
39.	Are adequate supplementary materials available in your school concerning aerospace education?		
	a. Yes	213	10.6%
	b. No	1,104	55.1%
	c. Some	524	26.2%

APPENDIX C

THE FOLLOW-UP QUESTIONNAIRE

QUESTIONNAIRE

Aerospace Workshops

in

the United States

Please circle appropriate choices

1. Age
   (a) 25 or under
   (b) 26-35
   (c) 36-45
   (d) 46-55
   (e) over 55

2. Sex
   (a) Female
   (b) Male

3. Primary position in the school system:
   (a) Teacher
   (b) Administrator
   (c) Supervisor of teachers
   (d) Counselor
   (e) Librarian
   (f) Other_____

4. Educational level of your position: (Check a combination if necessary)
   (a) Elementary
   (b) Junior High School
   (c) Senior High School
   (d) Junior College
   (e) College

5. (Elementary teachers only) Which description best fits your teaching situation?
   (a) One teacher teaching nearly all subjects
   (b) Special education
   (c) Art specialist
   (d) Music specialist
   (e) Science specialist
   (f) Mathematics specialist
   (g) Language arts specialist
   (h) Physical education specialist
   (i) Other_____

6. (Secondary teachers only) Subject area that you teach:
   (a) Science
   (b) Social Science
   (c) Humanities
   (d) Language Arts
   (e) Vocational training
   (f) Physical Education
   (g) Mathematics
   (h) Other_____

7. Your highest college degree or its equivalent:
   (a) Associate's
   (b) Bachelor's
   (c) Master's
   (d) Doctorate

8. Years of service to education:
   (a) 0-Student teacher
   (b) 1-5
   (c) 6-10
   (d) 11-15
   (e) 16-20
   (f) 21-25
   (g) Over 25

9. How many schools of the type where you teach are in your school district?
   (a) 1-5
   (b) 6-10
   (c) 11-20
   (d) Over 20

10. Do you teach in:
    (a) Public school
    (b) Private school
    (c) Parochial school
    (d) Other_____

11. Had you attended an aerospace workshop prior to last summer?
    (a) Yes
    (b) No

12. How did you become aware of last summer's aerospace workshop?
    (a) Published notice
    (b) Announcement by instructor or supervisor
    (c) Associates who have previously taken the course
    (d) Announcement by administrators
    (e) Other_____

13. Why did you attend last summer's aerospace workshop?
    (a) Undergraduate credit
    (b) Graduate credit
    (c) Recertification credit
    (d) Salary increment credit
    (e) Proficiency in the subject
    (f) Other_____

Please circle the appropriate choices

14. Which organization offered the workshop?
    (a) Local or County School Board
    (b) College Department of Education
    (c) College Department of Physics
    (d) College Department of Aeronautics
    (e) Other, please specify_____

15. When is the most suitable time for a workshop to be given?
    (a) Early summer
    (b) Midsummer
    (c) Late summer
    (d) During the school year
    (e) Other, please specify_____

16. To what extent were your expenses of last summer's aerospace workshop subsidized?
    (a) Zero
    (b) 25%
    (c) 50%
    (d) 75%
    (e) 100%

17. How long was the aerospace workshop you attended last summer?
    (a) 1-3 days
    (b) 1 week
    (c) 2 weeks
    (d) 3 weeks
    (e) 4 weeks
    (f) 6 weeks
    (g) 8 weeks
    (h) Longer

18. Was the workshop a segment of another course or a course by itself?
    (a) A segment of _____
    (b) A course by itself

19. How did you consider the pace of the workshop schedule?
    (a) Too fast
    (b) Too slow
    (c) Erratic, fast and slow
    (d) Appropriate

20. Were you housed with other workshop participants while taking the aerospace workshop?
    (a) Yes
    (b) No

21. In the aerospace workshop, did you work in small subgroups?
    (a) Yes, approximately 10 persons
    (b) Yes, approximately 15 persons
    (c) Yes, approximately 20 persons
    (d) No

22. Did you become well enough acquainted with most of the other participants to openly discuss your professional problems?
    (a) Yes
    (b) To a limited extent
    (c) No

23. How would you value the social interaction with fellow students in the workshop as compared to that of other "regularly-scheduled" college courses?
    (a) Considerably more valuable
    (b) Slightly more valuable
    (c) About the same
    (d) Slightly less valuable
    (e) Considerably less valuable

24. Do you feel another meeting of all your fellow aerospace workshop participants next year to compare teaching practices would be of value?
    (a) Yes
    (b) Undetermined
    (c) No

25. Was a flight in a small airplane a part of your workshop experience?
    (a) Yes
    (b) No

26. Was a United States Airforce airlift a part of your aerospace workshop experience?
    (a) Yes
    (b) No

27. For best results, what should be the length of a workshop course?
    (a) One week
    (b) Two weeks
    (c) Three weeks
    (d) Four weeks
    (e) Six weeks
    (f) Eight weeks
    (g) Other_____

Please circle the appropriate choices

28. On what topic were most of the activities conducted in the workshop?
(a) Aeronautics
(b) Space Science
(c) Benefits from space research
(d) Other _____

29. What percentage of the time in the aerospace workshop was spent on activities suitable for your own classroom use?
(a) 0%
(b) Less than 25%
(c) Less than 50%
(d) More than 50%

30. Did you have opportunity to participate in or develop activities recommended for classroom use while taking the workshop?
(a) No
(b) Part of them
(c) Most all of them

31. When is the most suitable time for a workshop to be given?
(a) Early summer
(b) Midsummer
(c) Late summer
(d) During the school year
(e) Other, please specify_____

32. Do you feel that teachers would attend a similar course if conducted in your school district during the school year?
(a) Yes
(b) No

33. Would you take a more advanced course in aerospace education?
(a) Yes
(b) No

34. Since your aerospace workshop experience, have you been of assistance to your faculty concerning this topic by giving talks or acting as a resource person?
(a) I've given talks to my faculty
(b) Yes, I've been a resource person
(c) Yes, both
(d) No

35. Since your aerospace workshop experience, have you participated in community activities concerning this topic by giving presentations to P.T.A., civic groups, etc.?
(a) Yes (please comment)_____
_____
(b) No

36. Since your aerospace workshop experience have you been more aware of current developments in aviation and space technology than before?
(a) Yes
(b) No

37. How many new techniques or activities for teaching concepts have you included in your lesson plans this year as a result of your workshop experiences?
(a) None
(b) 1-5
(c) 6-15
(d) 16-25
(e) over 25 (please comment)_____
_____

38. Have you felt more capable of helping students with projects as a result of your workshop experience?
(a) Yes
(b) About the same as before
(c) No

39. Have you felt more capable of assisting student groups in extra curricular activities such as science clubs since your workshop experience?
(a) Yes
(b) About the same as before
(c) No

40. Have you been able to bring new resource people to the classroom in the area of aerospace?
(a) Yes (please comment)_____
_____
(b) No (please comment)_____
_____

Please circle the appropriate choices

41. Has your class taken a field trip or outside activity of aerospace interest this year? (Please comment)
(a) Yes_____
(b) No_____

42. Do you feel that model building was an important activity in the workshop?
(a) Yes, expecially model rockets
(b) Yes, especially model airplanes
(c) Yes, both of the above
(d) Not especially
(e) No

43. What has the attitude of your administrators been this year concerning aerospace education?
(a) Positive
(b) Unconcerned
(c) Negative

44. Had you taught aerospace unit to your class before this year?
(a) Yes
(b) No

45. Have you initiated an aerospace unit in your classes this year?
(a) Yes
(b) No_____

46. Had you taught an aerospace course prior to attending the workshop?
(a) Yes
(b) No

47. Have you initiated an aerospace course in your school this year?
(a) Yes
(b) No_____

48. Do you have any FAA ground instructors' rating?
(a) Yes
(b) No

49. Are you a pilot?
(a) Yes-Student pilot
(b) Yes-Private pilot
(c) Yes-Coemercial pilot
(d) No, but plan to be
(e) No

50. Have you gained experience in flying since the aerospace workshop?
(a) Yes, as a pilot
(b) Yes, as a passenger
(c) No

51. Have you requested NASA materials since the aerospace workshop?
(a) Yes---films
(b) Yes---publications
(c) Yes---both of the above
(d) No

52. Have you ever seen a Spacemobile demonstration in a school?
(a) Yes
(b) No
(c) No, it visited my school but I missed it.

53. How much time did NASA lecturers contribute to last summer's aerospace workshop?
(a) One day or less
(b) Two or three days
(c) Four or five days
(d) More than a week

54. What should the duration of NASA's participation in an aerospace workshop be?
(a) Longer
(b) Shorter
(c) Just as it was

55. In general how would you rate the content of NASA's presentations for your use?
(a) Too simple
(b) Too difficult
(c) Appropriate

56. Have the activities conducted by NASA lecturers in the workshop been suitable for your use in school this year?
(a) Yes
(b) No

Please circle the appropriate choices

57. How much of the NASA information do you think you would be able to adopt for your students' learning experience?
    (a) Almost none
    (b) 1/4
    (c) 1/2
    (d) 3/4
    (e) Most

58. Were the NASA representatives available in last summer's aerospace workshop to work with you a sufficient length of time?
    (a) Yes, for lecture demonstrations only
    (b) Yes, for suitable classroom activities only
    (c) Yes, for both of the above
    (d) No

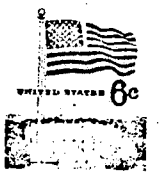
59. Which service should NASA Educational Programs Offices emphasize more to classroom teachers?
    (a) Availability of NASA publications
    (b) Availability of NASA films
    (c) Availability of the Spacemobile program
    (d) Availability of scientists as resource people
    (e) Aerospace classroom activities
    (f) Other

60. Which NASA subject area has been the most informative for reference in classes?
    (a) Manned Space Flight
    (b) Aeronautics
    (c) Future Space Exploration
    (d) Application Programs
    (e) Scientific Programs
    (f) Benefits to Mankind

61. Which NASA materials are of most value as teaching aids? (Models not included.)
    (a) Publications
    (b) Films

62. Overall, how would you evaluate the NASA materials used in the course?
    (a) Too technical for most of my students
    (b) Very good for student information
    (c) Good for motivating students
    (d) Not specific enough

Additional Comments



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APPENDIX D

RESULTS

Second Questionnaire

1.	Age		
	a. 25 or under	61	24.9%
	b. 26 to 35	53	21.6%
	c. 36 to 45	61	24.9%
	d. 46 to 55	47	19.2%
	e. Over 55	20	8.2%
2.	Sex		
	a. Female	160	65.3%
	b. Male	80	32.7%
3.	Primary position in the school system:		
	a. Teacher	214	87.3%
	b. Administrator	10	4.1%
	c. Supervisor of teachers	4	1.6%
	d. Counselor	1	0.4%
	e. Librarian	3	1.2%
	f. Other	10	4.1%
4.	Educational level of your position: (Check a combination, if necessary)		
	a. Elementary	138	56.3%
	b. Junior High School	64	26.1%
	c. Senior High School	54	22.0%
	d. Junior College	7	2.9%
	e. College	11	4.5%

5. (Elementary teachers only) Which description best fits your teaching situation?

a. One teacher teaching nearly all subjects	96	39.2%
b. Special education	3	1.2%
c. Art specialist	2	0.8%
d. Music specialist	3	1.2%
e. Science specialist	20	8.2%
f. Mathematics specialist	11	4.5%
g. Language	5	2.0%
h. Physical education specialist		
i. Other		

6. (Secondary teachers only) Subject area that you teach:

a. Science	46	18.8%
b. Social Science	14	5.7%
c. Humanities	4	1.6%
d. Language Arts	5	2.0%
e. Vocational training	7	2.9%
f. Physical Education	4	1.6%
g. Mathematics	17	6.9%
h. Other		

7. Your highest college degree or its equivalent:

a. Associate	5	2.0%
b. Bachelors	149	60.8%
c. Masters	85	34.7%
d. Doctorate	2	.8%

8. Years of service to education:

a. 0 to student teacher	22	9.0%
b. 1 to 5	87	35.5%
c. 6 to 10	38	15.5%
d. 11 to 15	37	15.1%
e. 16 to 20	24	9.8%
f. 21 to 25	10	4.1%
g. Over 25	24	9.8%

9. How many schools of the type where you teach are in your school district?

a. 1 to 5	109	44.5%
b. 6 to 10	43	17.6%
c. 11 to 20	29	11.8%
d. Over 20	47	19.2%

10. Do you teach in:

a. Public school	204	83.3%
b. Private school	0	0.0%
c. Parochial school	21	8.6%
d. Other	3	1.2%

11. Had you attended an aerospace workshop prior to last summer?

a. Yes	30	12.2%
b. No	214	87.3%

12.	How did you become aware of last summer's aerospace workshop?		
	a. Published notice	96	39.2%
	b. Announcement by instructor or supervisor	50	20.4%
	c. Associates who have previously taken the course	71	29.0%
	d. Announcement by administrators	35	14.3%
	e. Other	8	3.3%
13.	Why did you attend last summer's aerospace workshop?		
	a. Undergraduate credit	40	16.3%
	b. Graduate credit	85	34.7%
	c. Recertification credit	21	8.6%
	d. Salary increment credit	28	11.4%
	e. Proficiency in the subject	105	42.9%
	f. Other	11	4.5%
14.	Which organization offered the workshop?		
	a. Local or County School Board	15	6.1%
	b. College Department of Education	157	64.1%
	c. College Department of Physics	20	8.2%
	d. College Department of Aeronautics	22	9.0%
	e. Other, please specify	15	6.1%
15.	When is the most suitable time for a workshop to be given?		
	a. Early summer	109	44.5%
	b. Midsummer	73	29.8%
	c. Late summer	63	25.7%
	d. During the school year	7	2.9%
	e. Other, please specify	1	0.4%

16. To what extent were your expenses of last summer's aerospace workshop subsidized?

a.	Zero	148	60.4%
b.	25 percent	8	3.3%
c.	50 percent	11	4.5%
d.	75 percent	31	12.7%
e.	100 percent	36	14.7%

17. How long was the aerospace workshop you attended last summer?

a.	1 to 3 days	11	4.5%
b.	1 week	27	11.0%
c.	2 weeks	69	28.2%
d.	3 weeks	78	31.8%
e.	4 weeks	37	15.1%
f.	6 weeks	17	6.9%
g.	8 weeks	1	0.4%
h.	Longer		

18. Was the workshop a segment of another course or a course by itself?

a.	A segment of	9	3.7%
b.	A course by itself	232	94.7%

19. How did you consider the pace of the workshop schedule?

a.	Too fast	22	9.0%
b.	Too slow	6	2.4%
c.	Erratic, fast and slow	20	8.2%
d.	Appropriate	193	78.8%

20. Were you housed with other workshop participants while taking the aerospace workshop?

a. Yes	60	24.5%
b. No	181	73.9%

21. In the aerospace workshop, did you work in small subgroups?

a. Yes, approximately 10 persons	75	30.6%
b. Yes, approximately 15 persons	17	6.9%
c. Yes, approximately 20 persons	42	17.1%
d. No	105	42.9%

22. Did you become well enough acquainted with most of the other participants to openly discuss your professional problems?

a. Yes	137	55.9%
b. To a limited extent	88	35.9%
c. No	22	9.0%

23. How would you value the social interaction with fellow students in the workshop as compared to that of other "regularly scheduled" college courses?

a. Considerably more valuable	124	50.6%
b. Slightly more valuable	47	19.2%
c. About the same	59	24.1%
d. Slightly less valuable	8	3.3%
e. Considerably less valuable	4	1.6%

24. Do you feel another meeting of all your fellow aerospace workshop participants next year to compare teaching practices would be of value?

a. Yes	134	54.7%
b. Undetermined	81	33,1%
c. No	29	11.8%

25. Was a flight in a small airplane a part of your workshop experience?

a. Yes	135	55.1%
b. No	107	43.7%

26. Was a United States Airforce airlift a part of your aerospace experience?

a. Yes	87	35.5%
b. No	154	62.9%

27. For best results, what should be the length of a workshop course?

a. One week	11	4.5%
b. Two weeks	86	35.1%
c. Three weeks	69	28.2%
d. Four weeks	52	21.2%
e. Six weeks	25	10.2%
f. Eight weeks	4	1.6%
g. Other	1	0.4%

28. On what topic were most of the activities conducted in the workshop?

a. Aeronautics	122	49.8%
b. Space Science	109	44.5%
c. Benefits from space research	34	13.9%
d. Other	14	5.7%

29. What percentage of the time in the aerospace workshop was spent on activities suitable for your own classroom use?

a. Zero	7	2.9%
b. Less than 25 percent	60	24.5%
c. Less than 50 percent	72	29.4%
d. More than 50 percent	96	39.2%

30. Did you have an opportunity to participate in or develop activities recommended for classroom use while taking the workshop?

a. No	27	11.0%
b. Part of them	141	57.6%
c. Most of them	71	29.0%

31. When is the most suitable time for a workshop to be given?

a. Early summer	101	41.2%
b. Midsummer	76	31.0%
c. Late summer	57	23.3%
d. During the school year	8	3.3%
e. Other, please specify	1	0.4%

32. Do you feel that teachers would attend a similar course if conducted in your school district during the school?

a. Yes	171	69.8%
b. No	51	24.4%

33. Would you take a more advanced course in aerospace education?

a. Yes	186	75.9%
b. No	50	24.4%

34. Since your aerospace workshop experience, have you been of assistance to your faculty concerning this topic by giving talks or acting as a resource person?

a. I've given talks to my faculty	14	5.7%
b. Yes, I've been a resource person	69	28.2%
c. Yes, both	28	11.4%
d. No	131	53.5%

35. Since your aerospace workshop experience, have you participated in community activities concerning this topic by giving presentations to PTA, civic groups, et cetera?

a. Yes (Please comment)	17	6.9%
b. No	214	87.3%

36. Since your aerospace workshop experience, have you been more aware of current developments in aviation and space technology than before?

a. Yes	227	92.7%
b. No	13	5.3%

37. How many new techniques or activities for teaching concepts have you included in your lesson plans this year as a result of your workshop experiences?

a. None	37	15.1%
b. 1 to 5	115	46.9%
c. 6 to 15	57	23.3%
d. 16 to 25	8	3.3%
e. Over 25 (please comment)	9	3.7%

38. Have you felt more capable of helping students with projects as a result of your workshop experiences?

a. Yes	187	76.3%
b. About the same as before	31	12.7%
c. No	10	4.1%

39. Have you felt more capable of assisting student groups in extra-curricular activities, such as science clubs since your workshop experience?

a. Yes	121	49.4%
b. About the same as before	55	22.4%
c. No	47	19.2%

40. Have you been able to bring new resource people to the classroom in the area of aerospace?

a. Yes (please comment)	49	20.0%
b. No (please comment)	161	65.7%

41. Has your class taken a field trip or outside activity of aerospace interest this year?

a. Yes	43	17.6%
b. No	168	68.6%

42. Do you feel that model building was an important activity in the workshop?

a. Yes, especially model rockets	118	48.2%
b. Yes, especially model airplanes	2	0.8%
c. Yes, both of the above	53	21.6%
d. Not especially	39	15.9%
e. No	22	9.0%

43. What has the attitude of your administration been this year concerning aerospace education?

a. Positive	129	52.7%
b. Unconcerned	88	35.9%
c. Negative	0	0.0%

44. Had you taught aerospace unit to your class before this year?

a. Yes	74	30.2%
b. No	153	62.4%

45. Have you initiated an aerospace unit in your classes this year?

a. Yes	115	46.9%
b. No	97	39.6%

46. Had you taught an aerospace course prior to attending the workshop?

a. Yes	42	17.1%
b. No	193	78.8%

47. Have you initiated an aerospace course in your school this year?

a. Yes	29	11.8%
b. No	187	76.3%

48.	Do you have an FAA ground instructor's rating?		
	a. Yes	8	3.3%
	b. No	230	93.9%
49.	Are you a pilot?		
	a. Yes, student pilot	4	1.6%
	b. Yes, private pilot	12	4.9%
	c. Yes, commercial pilot	6	2.4%
	d. No, but plan to be	17	6.9%
	e. No	203	82.9%
50.	Have you gained experience in flying since the aerospace workshop?		
	a. Yes, as a pilot	12	4.9%
	b. Yes, as a passenger	47	19.2%
	c. No	180	73.5%
51.	Have you requested NASA materials since the aerospace workshop?		
	a. Yes, films	18	7.3%
	b. Yes, publications	69	28.2%
	d. Yes, both of the above	50	20.4%
	e. No	112	45.7%
52.	Have you ever seen a Spacemobile demonstration in a school?		
	a. Yes	104	42.4%
	b. No	134	54.7%
	c. No, it visited my school, but I missed it	2	0.8%

53. How much time did NASA lecturers contribute to last summer's aerospace workshop?

a. One day or less	37	15.1%
b. Two or three days	101	41.2%
c. Four or five days	61	24.9%
d. More than a week	42	17.1%

54. What should the duration of NASA's participation in an aerospace workshop be?

a. Longer	120	49.0%
b. Shorter	5	2.0%
c. Just as it was	113	46.1%

55. In general, how would you rate the content of NASA's presentation for your use?

a. Too simple	6	2.4%
b. Too difficult	9	3.7%
c. Appropriate	223	91.0%

56. Have the activities conducted by NASA lecturers in the workshop been suitable for your use in school this year?

a. Yes	185	75.5%
b. No	38	15.5%

57. How much of the NASA information do you think you would be able to adopt for your students' learning experience?

a. Almost none	24	9.8%
b. 1/4	61	24.9%
c. 1/2	59	24.1%
d. 3/4	23	9.4%
e. Most	68	27.8%

58. Were the NASA representatives available in last summer's aerospace workshop to work with you a sufficient length of time?

a. Yes, for lecture demonstrations only	80	32.7%
b. Yes, for suitable classroom activities only	7	2.9%
c. Yes, for both of the above	112	45.7%
d. No	46	18.8%

59. Which service should NASA Education Programs Office emphasize more to classroom teachers?

a. Availability of NASA publications	40	16.3%
b. Availability of NASA films	68	27.8%
c. Availability of the Spacemobile program	101	41.2%
d. Availability of scientists as resource people	54	22.0%
e. Aerospace classroom activities	117	47.8%
f. Other	5	2.0%

60. Which NASA subject area has been the most informative for reference in classes?

a. Manned Space Flight	124	50.6%
b. Aeronautics	28	11.4%
c. Future Space Exploration	40	16.3%
d. Application programs	24	9.8%
e. Scientific programs	13	5.3%
f. Benefits to Mankind	88	35.9%

61. Which NASA materials are of most value as teaching aids? (Models not included.)

a. Publications	75	30.6%
b. Films	164	66.9%

62. Overall, how would you evaluate the NASA materials used in the course?

a. Too technical for most of my students	36	14.7%
b. Very good for student information	121	49.4%
c. Good for motivating students	106	43.3%
d. Not specific enough	5	2.0%

APPENDIX E

LIST OF PARTICIPATING WORKSHOPS

Workshop Respondents to the Questionnaire

Abington School District, 1841 Susquehanna Street, Abington, Pennsylvania 19001

Adams State College, Educational Building, Room 103, Alamosa, Colorado 81101

Ashland College, Kettering Center, Ashland, Ohio 44805

Bemidji State College, Room 217 Spettgast Hall, Bemidji, Minnesota 56602

Berry College, Department of Education and Psychology, Mount Berry, Georgia 30149 (two different workshops)

Birmingham Southern College, Room 11 Ramsay Hall, Birmingham Southern College, Birmingham, Alabama 35204

Boone County Schools, Scott High School, 404 Riverside Drive, Madison, West Virginia 25130

California State Polytechnic College, School of Applied Arts Building, San Luis Obispo, California 93401

California State Polytechnic College, 3801 West Temple Avenue, Pomona, California 91766

California State College, Long Beach, California State College, 6101 East Seventh Street, Long Beach, California 90801

California State College, Hayward, Biology Department, 25800 Hillary Street, Hayward, California 94542

Catawba County Schools, Fred T. Ford Junior High School, 1001 East 25th Street, Newton, North Carolina 28658

Central Michigan University, Brooks Hall, Mount Pleasant, Michigan 48858

Chabot Science Center, Director, 4917 Mountain Boulevard, Oakland, California 94619

Chestnut Hill College, Administration Building, Germantown and Northwestern Roads, Philadelphia, Pennsylvania 19118

Colorado State University, 343 Ross Hall, Greeley, Colorado 80631

C. W. Post College, Room 258, Life Science Building 120, Brookville, New York

Eastchester Public Schools, Aerospace Discovery Workshop, Eastchester Junior High School, 550 White Plains Road, Eastchester, New York 10707

Eastern Washington State College, Cheney, North 7222 Excell Drive, Spokane, Washington 99208

Fayette County Public Schools, Board of Education, 400 Lafayette Parkway, Lexington, Kentucky 40503

Fayette County Schools, Title III Office, 242 Third Street, California, Pennsylvania 15419

Florida Institute of Technology, Country Club Road, Melbourne, Florida 32901

Fresno State College, 1002 East Yale Street, Fresno, California 97304

Georgia Southern College, Department of Industrial Education, Landrum Center, Statesboro, Georgia 30458

Hershey County Schools, Hershey Senior High School, Room 19, Homestead Road, Hershey, Pennsylvania 17033

Idaho State University, 1321 South Pacific, Boise, Idaho 83705

Illinois State University, Normal, Illinois 61761

Indiana State University, Room 103 Holmstedt Hall, Indiana State University, Terre Haute, Indiana 47809

Indiana University, Science Education Department, 337 Education Building, Bloomington, Indiana 47405

J. F. Kennedy Space Center (On-Center Pilot Program), PA EPB, KSC, Florida 32899

Kansas State University, Room 206B, Holton Hall, Manhattan, Kansas 66502

MacGregor Resources and In-Service Center, Science Laboratory Building, 4801 La Branch, Houston, Texas 77004

Mankato State College, Mankato, Minnesota 56001

Memphis State University, Department of Elementary Education, Room 417, Education Building, Memphis, Tennessee 38111

Miami University, 6219 Market Street, Youngstown, Ohio 44512

Michigan State University, 363 Erickson Hall, East Lansing, Michigan 48823

Mount St. Mary's College, 12001 Chalon Road, Los Angeles, California 90049

Moorhead State College, Science Building, Moorhead State College, Moorhead, Minnesota 56560

Newark State College, Townsend Hall, Morris Avenue, Union, New Jersey 07083

New Mexico State University, 316-317 Odonnel, Las Cruces, New Mexico 88001

Northern Illinois University, DeKalb, Illinois 60115

Northern Michigan University, West Science Building, Marquette, Michigan 49855

Oklahoma Aeronautics Commission, Whitehurst Hall, Room 315, Oklahoma State University, Stillwater, Oklahoma 74074

Palomar College, Room CH-4, Highway 78, San Marcos, California 92069

Parksley High School, 101 Jones Avenue, Parksley, Virginia 23421

Pennsylvania State University, 142 Chanbers Building, Pennsylvania State University, University Park, Pennsylvania 16802

Peru State College, Fine Arts Building, Room 212, Fifth and Hoyt Streets, Peru, Nebraska 68421

Plaza Junior High School, 3080 South Lynnhaven Road, Virginia Beach, Virginia 23452

Plymouth State College of the University of New Hampshire, Russell House, Plymouth, New Hampshire 03264

Puget Sound Area Schools, Pacific Science Center, 200 Second Avenue North, Seattle, Washington 98109

Robert Smalls High School, 1001 Ribaut Road, Beaufort, South Carolina 29902

Sacramento State College, School of Education, 6000 Jay Street, Sacramento, California 95819

Saint Francis College, Science Building, 2701 Spring, Fort Wayne, Indiana 47708

San Jacinto College, Technical Building, 8060 Spencer Highway, Pasadena, Texas 77505

Southern Illinois University, Wam Building, Carbondale, Illinois 62901

Stanislaus State College, c/o San Joaquin County Instructional Media Center, 1465 Lindberg Street, Stockton, California 95206

Temple University, Room 264--Ritter Hall, Montgomery Avenue, Philadelphia, Pennsylvania 19122

Union College, Barbourville, Kentucky 40906

University of Alabama, Room 204--Graves Hall, Tuscaloosa, Alabama 35486

University of British Columbia, Vancouver, Faculty of Education, Education Building, Science Education Department, Room 1209 Vancouver, British Columbia, Canada

University of Florida, Department of Education, Room 175, Norman Hall, Gainesville, Florida 32601

University of Georgia, Department of Science Education, Baldwin Hall, Room 103, Athens, Georgia 30601

University of Hawaii, 1776 University Avenue, Honolulu, Hawaii 96822

University of Minnesota, AFROTC Building, Duluth Campus, Duluth, Minnesota 55812

University of Nebraska, College of Education, 31 E. Lincoln, Nebraska 68501

University of Nevada, Las Vegas, 1487 South Eighth Street, Las Vegas, Nevada 89109

University of Nevada, Reno, Teaching and Resource Center, Reno, Nevada 89104

University of Puerto Rico, Industrial Arts Department, Rio Piedras, Puerto Rico 00931

University of Redlands, Administration Building, Redlands, California 90723

University of South Alabama, Classroom Building, Room 440, Mobile, Alabama 36608

University of South Florida, Department of Physics and Education, PHY110, Tampa, Florida 33620

University of West Virginia, 1210 Thirteenth Street, Parkersburg, West Virginia 26102

Valdosta State University, Education Department, Box 176, North Campus, Valdosta, Georgia 31601

Wayne State College, Carhart Science Hall, Room 134, Wayne, Nebraska 68787

Western State College, School of Education Building, Room K-109, Gunnison, Colorado 81230

Westmoreland County Public Schools, Courthouse Annex, Greensburg, Pennsylvania 15601

Wisconsin State University, Campus Lab School, Stevens Point, Wisconsin 54481

Wisconsin State University, Barstow Hall, Superior, Wisconsin 54881

VITA

Robert Dale Helton

Candidate for the Degree of

Doctor of Education

Thesis: A STUDY OF AEROSPACE EDUCATION WORKSHOPS WHICH UTILIZE NASA MATERIALS AND RESOURCE PERSONNEL

Major Field: Higher Education

Biographical:

Personal Data: Born in Salina, Kansas, January 8, 1932, the son of Mr. and Mrs. W. A. Helton. Married; wife, Darlene, is a teacher and daughter, Rebecca, is 14.

Education: Graduated from Greenburg High School, Greenburg, Kansas, in May, 1950; received a Bachelor of Arts degree from Fort Hays Kansas State College in May, 1956; received the Master of Science degree from Miami University of Ohio in August, 1963; completed requirements for the Doctoral degree at Oklahoma State University in July, 1973.

Professional Experience: Taught all the sciences at Meade High School, Meade, Kansas, for one year, 1956-1957. Taught all the sciences and aeronautics for five years at Hill City High School, Hill City, Kansas, 1957-1962. Member of the Kansas Commission for Aerospace Education, 1958-1962. Graduate assistant teaching in the Aeronautics Department as Ground Instructor for pilots at Miami University of Ohio, 1962-1963. Spacemobile lecturer and later Programs Coordinator for the Educational Programs Branch of the National Aeronautics and Space Administration with the Manned Spacecraft Center, Houston, Texas, 1963-1968. Represented NASA to work at the University of Paris in assisting the French develop a public relations program to visit schools, 1966. Graduate assistant in Education at Oklahoma State University assisting in NASA-University related programs, 1968 to present (assigned to NASA, Langley Research Center, Hampton, Virginia).