MATERIALS, PRACTICES, AND PERCEPTIONS ASSOCIATED WITH
PRIOR PARTICIPATION IN AN AEROSPACE
EDUCATION WORKSHOP: A CASE STUDY

DISSERTATION

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By

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This qualitative study was conducted in a large north Texas school district. The subjects were four elementary teachers who had previously attended a summer aerospace education workshop. The researcher observed in each classroom during science instruction and other areas where aerospace concepts might be taught to determine material usage, practices, and perceptions associated with teaching aerospace. The teachers' lesson planbooks, textbooks, and supplementary materials were also examined by the researcher. Interviews were conducted with each teacher's principal and the district science coordinator to determine their effects on the practices and perceptions of the subjects.

**Findings and Conclusions:**

1. The teachers used a wide variety of aerospace education materials in their classrooms. All the subjects utilized activities from the Young Astronaut Program.

2. The teachers chose to use aerospace education materials in all areas of the curriculum. The materials were presented in a variety of ways, with emphasis on hands-on instruction and experimentation.

3. The workshop provided an abundance of materials to the teachers. The researcher identified thirty-one separate sources utilized by the teachers in obtaining aerospace education materials. NASA, the CAP, and the
Young Astronaut Program were identified as sources for all of the subjects.

4. The teachers utilized a variety of enhancements. They included: films, videos, guest speakers, field trips, computers, television, and balloon and rocket launches.

5. The subjects utilized an approach which emphasized hands-on discovery and experimentation. The workshop practicum experience, no longer a part of present workshops, influenced the participants' approach to science instruction and utilization of aerospace materials.

6. The administrators were supportive of the use of aerospace education as a curriculum enhancement. The participants felt pressure in having to document the use of the aerospace materials in order to satisfy the requirements set by the Texas essential elements.

Recommendations: The utilization of aerospace education workshops should continue with reinstatement of the practicum experience.
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CHAPTER I

INTRODUCTION

Virtually every era of human civilization has contained references to flight (Bilstein, 1984). In ancient myths and legends, such as the Greek's Icarus and the German's Valkyries, themes of flight occur again and again. The first documented drawings of 'flying machines' were those of Leonardo DaVinci's ornithopter (Cutry, 1976).

December 14, 1903, Wilbur and Orville Wright accomplished a goal that had captivated dreamers and experimenters throughout recorded history; powered, sustained flight. The Wright's success ushered in the age of aviation, which in turn fostered the developments that led to the age of space exploration. The combination of these technological advances, and the manner in which they permeate man's existence, is the base of aerospace education.

Texas has issued specific State Department of Education Bulletins concerning aerospace-aviation education since the early 1940's. In these bulletins there have been guidelines for curriculum content and development, appropriate grade level designation for various phases of the material, and recommendations concerning teacher training. During the 1970's and 1980's Texas instituted curriculum changes which made aerospace-aviation education a part of the science curriculum (TEA, 1978; House Bill 246, 1981; Title 19, Chapter 75, 1984). The teaching of science
began to be emphasized as a result of the launching of Sputnik in 1957.

Current literature indicates that the United States student population is falling behind many other countries in science education (NCE, 1983). This poor performance may be due to a lack of relevancy in science and technological concepts for the student population. Bracey (1988) contends that whether most students find science meaningful and useful depends more on how teachers connect science to relevant social issues than on the accumulation of unrelated facts.

The integration of aerospace concepts into the science curriculum, and more broadly into all curriculum areas, provides relevancy for students in technological issues. The effects these technological advances have on society is undeniable. An article in the Ft. Worth Star Telegram (June 24, 1989) discussed an exhibit at Chicago's Museum of Science and Industry. The article explained that more than 30,000 items, including such diverse sources as the Jarvik artificial heart and Velcro, have been developed from technology associated with the nation's space program.

Former President Ronald Reagan was a supporter of the goals of aerospace education since the early sixties. The following statement was made to the Third Biennial World Congress on Aerospace Education:

Aviation and space technologies have unlimited potential not only for meeting industrial, commercial, and leisure needs, but also, for offering insights and solutions to scientific problems and challenges. By expanding our knowledge and understanding, aerospace and aviation education can extend our reach and inspire our young people, the builders and inventors of the future (Reagan, 1983, p.1).
Guskey (1985) has stated that the most significant changes in teacher attitudes and beliefs come after they begin using a new practice successfully and see changes in student learning. Determining attitudes and practices after attendance at an aerospace education workshop session will help in extending present in-service functions and evaluating the effect of this material on students.

Purpose of the Study

The purpose of this study was to observe and interview teachers who had attended an aerospace education workshop in the north Texas area to determine the use of materials, practices, and perceptions associated with the teaching of aerospace education.

Research Questions

The purpose of this study was to determine answers in the following areas as they pertained to teachers who had attended an aerospace education workshop.

1. What aerospace materials, if any, were being used in the classrooms of teachers who had attended an aerospace education workshop?

2. In which subject areas did these same teachers choose to use aerospace education materials? How were the materials presented to the students?

3. Did the aerospace education workshop help provide sufficient educational materials for the teachers' use? What specific agencies have provided material?
4. What enhancements (field trips, speakers, films etc.) did the teachers use in conjunction with the aerospace education material?

5. What effect had attending an aerospace education workshop had on the teaching practices of the teachers involved?

6. What effect did administrators have on the use of aerospace education materials, practices, and perceptions of the teachers being studied?

Significance of the Study

The last, formally published, evaluation concerning the effectiveness of Texas aerospace education workshops was conducted more than twenty years ago (Dolezal, 1968). The previous study of Texas aerospace education practices was measured only at the college and secondary school level.

Evaluation of many aerospace workshops in the past has been by use of a self-reporting questionnaire (Miller, 1972; Romero, 1973; Maupin, 1975; Marcum, 1978). Research has shown that self-reporting techniques are rarely as reliable as direct observation (Borg & Gall, 1983). This study was the first to use direct observation of aerospace education practices in the elementary classroom.

The qualitative approach utilized an interview and observation technique. It provided for an in-depth means of reporting information on four participants of an aerospace education workshop. This study could be a model for future research in determining the actual use of information gained during an aerospace education workshop. This study might also be helpful in determining the value of continuing workshops in north Texas.
Definition of Terms

The following terms were defined for use in this study:

1. Aviation education: refers to the branch of education concerned with the acquisition of knowledge and skills associated with aviation and its interaction with society. It was used primarily in the time period before the 1957 launch of Sputnik.

2. Aerospace education: aerospace education is differentiated from aviation education in that it refers to the total realm of aviation and space exploration.

3. Aerospace-Aviation education: is unique to Texas literature. It has been used since 1968 to describe the curriculum in Texas which concerns itself with aerospace principles.

4. Aerospace education workshop: refers to those credit courses offered at a college or university during the summer session.

5. In-service: refers to any opportunity afforded teachers, during the regular school year, to supplement their teaching skills in a workshop or in-school training session.

6. Aviation/aerospace agencies: refers to the Civil Air Patrol (CAP), the Federal Aviation Administration (FAA) and its predecessors; the Civil Aviation Administration (CAA) and Federal Aviation Agency (FAA), and the National Aeronautics and Space Administration (NASA), and its predecessor the National Advisory Committee for Aeronautics (NACA). The Young Astronaut Program (YAP) is considered in this same category.
Limitations

Data were gathered by means of interviews with teachers and administrators, observation during science instruction and other appropriate class periods, and examination of lesson plans, curriculum guides and applicable written material, then analyzed qualitatively. Because of the qualitative approach utilized in this study, broad generalization to other settings are inappropriate.

Assumptions

It was assumed that the teachers were open and honest during the interview process.

Data Analysis

The constant comparative strategy of data analysis was utilized (Bogdan & Biklen, 1982; Glaser, 1978; Stainback & Stainback, 1988).

Data were analyzed to determine categories, patterns, consistencies, and inconsistencies. Once patterns began to appear, these were sorted and compared to determine subsequent relationships. Material collected throughout the process had a bearing on the direction the research took. This same iterative process was used for data analysis involving observation and interview with teachers, analysis of written material, and interviews with administration.

The process above developed a theory which was constantly revised during this period. Theory, as it applies to qualitative research, refers to the loose collection of logically held-together assumptions, propositions, or
concepts that orient the research and thinking.

The final phase of analysis occurred when all data had been collected. Data on the individual teachers was compared to detail similarities and differences, then the remainder of the data, concerning administrators and artifacts, were added so that comparisons could be made in determining the existing relationships and their bearing on the research questions.
CHAPTER II

REVIEW OF RELATED LITERATURE

The following review of literature contains information relating to the development of aerospace education presented in a five-part format. It begins with an historical perspective pertaining to the development of aviation and aerospace education programs. The second part of this section presents a synopsis of the research in aerospace education. The third section discusses Aviation/Aerospace Agencies. The next section discusses the concerns for the relevancy of present science curriculum. The final section includes an overview of aerospace education in the state of Texas.

Aviation and Aerospace Education Programs

Development From 1900 To 1930

Man's victory in the attainment of powered, sustained flight by the Wright brothers in 1903 thrust the world into a new era of advancement. Strickler (1983) pointed out that a study of the history of scientific and technological inventions and developments clearly demonstrated that it often took a generation or more before a technological breakthrough was widely understood or adopted into school and college curricula. A definite exception to this was in the realm of aviation and aerospace.

The first formal record of an aviation education program in a school system appeared in 1908 detailing physics classes taught by H. Lav.
Twinning at Polytechnical High School in Los Angeles. (Strickler, 1968). This period of time also marked the development of pilot training programs by the United States government.

As early as 1922 public schools in Detroit, Michigan, had begun to offer aircraft model building as formal, credit courses. According to Strickler (1983) these classes were later expanded into aeronautical and automotive subjects. Another model program developed in the 1920's was begun in Galt, California. In 1925 the program for ground training and flight instruction was instituted in the high school and by 1926 the Galt Junior College program was developed which extended training two years beyond high school. This was the first record of a college course offering for flight training.

One of the most significant advancements in the area of aviation education came with the development of the Guggenheim Fund. This Fund was created with an endowment of $2.5 million. The purpose of the fund was twofold: "Broadly speaking, the work of the fund is directed towards the two objectives of developing the efficiency and safety of commercial aviation, and in stimulating public recognition of the achievements" (Spaulding, 1929, p. 6).

One of the earliest large-scale efforts involving aviation education for teachers was also in conjunction with the Guggenheim Fund. A workshop was held at New York University during the 1928 Summer Session. The participants included teachers from both the elementary and secondary levels (Romero, 1973).

Strickler (1968) pointed out that Dr. William F. Durand was one of the
key figures in the evolution of aviation and aerospace developments in areas encompassing technology and education. Dr. Durand was one of the original members of the National Advisory Committee on Aeronautics (NACA) which was the predecessor of the National Aeronautics and Space Administration (NASA). NACA was established in 1915 by President Woodrow Wilson (Anderton, 1978). While a Professor of Engineering at Stanford, Dr. Durand was asked to address the 1928 annual meeting of the Superintendents of Schools in Boston, Massachusetts. The speech dealing with public needs of aeronautic education outlined these specific points:

1. Aeronautics stands ready to offer to society and to the cause of human progress, a service.

2. The public is divided into two classes insofar as aeronautic services are concerned; those who render the service and those who receive it.

3. Education for those rendering aeronautical service must be technical, professional, and vocational.

4. For the great public at large; those who receive aeronautical service, the education which is significant is that which will permit them to use wisely and sanely the service offered.

5. There must be developed within the body of society at large something of what is implied in the newly coined word "air-mindedness" (Strickler, 1968, p. 310).

**Development From 1930 to 1950**

In June, 1939, Congress passed the Civil Pilot Training Act (CPT). The
CPT program was administered by the Civil Aeronautics Authority (CAA) beginning with 13 colleges and 331 students. By July, 1942, the CAA had operational contracts with 268 private schools, 884 colleges, 195 high schools, 120 civic organizations, and 1,250 flight instruction contractors (Strickler, 1968).

The CPT also triggered a new series of programs in the secondary schools. The basic goal of the "pre-flight aeronautics" was teaching the fundamentals of the principles of flight to the young men preparing to become military pilot training candidates (Thomassen, 1968). The success of these pilot training programs influenced the success of aviation education programs for the next decade (Matson, 1983).

Another product of the pilot training programs during World War II was the educational material written in a joint effort by the CAA and the U.S. Office of Education. The goal of the booklet *Air-Conditioning Young America* (CAA, 1942) was to assist secondary schools in the introduction of training programs in their schools. The efforts consisted of two activities. One was the provision of additional training materials for the teachers and the second was specifically for the training of qualified instructors. The training material that was developed included textbooks, suggested syllabi for classroom use and bibliographies for resources. During this period of intensive development and promotion, 1942-1944, it was estimated that fully half of the nation's high schools offered some type of aviation course (Strickler, 1968).

The lack of specific materials and training for the instructors led to more extensive work in providing background information for teachers. The
influence of the CAA reached its peak in 1947 when its efforts were expanded to include summer aviation workshops for teachers (Duca, 1985). These collaborative efforts of the CAA with its Aviation Education Division were described as follows:

The services of 15 different cooperating agencies were employed by the 73 different teacher training institutions, throughout 38 different states, conducted during the summer months of 1947. In these aviation education workshops, 428 general classroom and science of aeronautics teachers were reached. It is noteworthy that by October 1, 1947, requests had been received from 96 teacher training institutes for assistance in conducting aviation education workshops in 1948. (Wright & Sinclair, 1948, p. 262)

The American Association of Colleges for Teacher Education (AACTE) published a report written by their Aviation Education Committee. This report outlined 14 essential steps for incorporation into an aviation education program (AACTE, 1949). The recommended outline developed by the committee was adopted by the Federal Aviation Administration (FAA) for incorporation into their workshop planning guide which was in use up until 1962 (FAA, undated). The recommendations from the AACTE committee were as follows:

1. An adequate reading and speaking vocabulary of aviation.
2. Knowledge of the importance of weather and climate to successful aviation.
3. A general knowledge and understanding of airplane structure.
4. A general knowledge and understanding of the simple scientific
principles of flight.

5. An understanding of the place of aviation in peace and war.

6. An understanding of the effects of air transportation on various levels of international relationships.

7. An introduction to the social, economic, and political implications of current and future aviation development.

8. An appreciation of the services rendered by airports and their associated personnel.

9. Familiarity with existing and needed basic governmental services, regulations, and relationships in aviation.

10. A knowledge of available education resources in materials, personnel, and equipment for instructional purposes.

11. The know-how for organizing units of aviation education and providing resulting learning experience for children through student or directed teaching.

12. A realization of the growing interdependence of people through aviation.

13. An understanding of problems; political, economic, international, and social, that aviation has created and the institutions society has established to solve these problems.

14. A realization of how the airplane has changed geographic relationships; particularly in terms of mankind's concepts of time, place, and distance and mankind's attitudes toward waterways, land masses, and land and water barriers. (AACTE, 1949, p. 3).

Also in 1949, a committee appointed by the American Association of
School Administrators (AASA) met in Washington D.C. to review the recommendations made by the Association's Aviation Education Workshops. The committee recommended an exhaustive and comprehensive study be undertaken in order to understand the current practices utilized by instructors in aviation education and to prepare written guides and materials for instruction (AASA, 1950).

Development From 1950 To 1970

By 1952 the influence of the CAA was in decline due to budget reductions. At this time the emergence of two new organizations; the National Aviation Education Council and the Civil Air Patrol (CAP), began to replace the waning effect of the CAA. The CAP had its beginning in 1941, but did not exert great educational influence until the 1950's (Meadows, 1984).

A precedent for aviation education was set when the North Central Association of Colleges and Schools recognized and endorsed the CAP program. This statement was issued in November 1951 and reaffirmed in June 1960: "In those member schools desiring to offer a course in aviation as set up by the Civil Air Patrol this course may be offered for graduation, as well as for college admission as a credit in science" (Thomasen, 1968, p. 410).

On October 4, 1957, an event occurred which had astounding impact upon the life of each person on earth. The Space Age officially began with the launching of the Russian Sputnik, the first man-made earth orbiting object. Cox (1970) stated that there was an even broader expansion of aviation subject matter which would now cover the study of earth's environment. Aviation education became aerospace education.
The CAA was absorbed into the newly created Federal Aviation Agency (FAA) shortly after the launching of Sputnik. By action of the Space Act of 1958 NACA officially became NASA. NASA became a focal point in the growth of aerospace education in the 1960’s (Helton, 1973). The Educational Division of the agency developed an extensive set of goals to help establish their relationship with the educational community. (See Appendix A.)

The challenge of the 1960's seemed to be rooted in the new race for space begun by Sputnik. Concern of educators concentrated on the new scientific revolution and was echoed in the cooperative, bi-partisan work done at the governmental levels. The National Defense Education Act was passed by a Democratic Congress and signed by a Republican President. The act encouraged the development of programs in science, mathematics, and foreign languages in United States schools and colleges (Jennings, 1987).

The period of time from the early 1960's through the late 1970's saw the development of a wealth of information for educators interested in promoting aerospace education. Information guides, bibliographies, lesson plans, and curriculum sets were just a sampling of the materials issued from the aerospace education workshops during this period. Many of these projects were funded under Title III of the Elementary-Secondary Education Act of 1965 (Lincoln Public Schools, 1965; Kent State, 1972). Again, NASA, the FAA, and the CAP were leaders in presenting and sponsoring workshops and developing materials.

Aircraft manufacturers also increased efforts at providing materials for educators. The General Aviation Manufacturers Association (GAMA) along with several major general aviation companies such as Beech, Cessna, and
Piper Aviation Corporations all had specific aerospace education offices equipped to fill any void in providing educational units and speakers for projects (GAMA, 1983). Many airlines began to provide information services to the educators through this period. American, Eastern, Trans-World, and United were particularly active in this endeavor (Bilstein, 1984).

The field of aerospace education gained more credibility among educators with endorsements from many of their own professional organizations and associations. Strickler (1983) explained that policy statements were issued by such groups as AASA, The American Council on Education (ACE), and the National Secondary School Principals Association (NSSPA).

The full impact of the space age began to reach into man's daily existence. With the accomplishment of President John F. Kennedy's objective of reaching the moon within the decade the world had expanded its physical reach beyond anything previously imaginable. The far future had become reality. This thought was expressed in a statement contained in a task force committee report ordered, in 1969, by then Governor of California, Ronald Reagan:

There is a need today for a mechanism for translating the future into the educational implements of the present in our nation's schools. Aerospace-aviation education can be one of those mechanisms. This new educational discipline could be actively utilized by our schools--not for reaching the moon--but to reach for the inside of students' minds. (Governor's Aerospace-Aviation Task Force, 1973, p. 12).
Development From 1970 To 1989

It was a fact of life for educators to be bound to the economic swings inherent in American culture. The economic recession of the 1970's caused a decline in many worthwhile education projects. Committees in aerospace education often did not have a working budget. This lack of funding caused projects to be abandoned and many capable individuals to be impeded in their efforts to further aerospace education (Neal, 1977).

The hiring of a new corps of astronauts in 1978 began an upswing in interest in aerospace. The country, having grown complacent with the absence of any real space exploration endeavors since the completion of the Gemini and Apollo projects, began to build a renewed interest in space activities (Dewaard & Dewaard, 1988).

As the push for science education built with the technological advancements of the era, aerospace education was increasingly being moved from a separate discipline to one incorporated into the science curriculum. The lack of support for continued space exploration during the 1970's, after completion of the lunar expeditions, caused a cry of concern from the science community in the 1980's (Yaeger & Penick, 1987). Federal and state involvement in the funding of educational programs enhanced this combined curriculum (Matson, 1983).

Aerospace education had in the past suffered from periods of decline in interest in the schools followed by significant upswings. The surges in interest had usually been caused by some major event such as; the flight of the Wright brothers in 1903, the necessity of training in aviation during World War II, and the launching of Sputnik in 1957 (Meadows, 1985).
The successful launch of the Space Shuttle Columbia in 1981 rekindled that interest and gave NASA the means of stimulating the study of science and technology in the nation's schools. The agency ran an annual competition, the "Get Away" special. This activity, in conjunction with the National Science Teacher's Association (NSTA), provided a means of technological competition for high school students in developing various experiments which ultimately would be selected to fly aboard specified shuttle missions (Cookson, 1981).

The launching of the Space Shuttle Challenger on June 18, 1983, provided another first in aerospace. Dr. Sally Ride, a physicist, became the first American female in space. It would no longer be a dream for a young woman to choose a career in science with space exploration as an end goal (Ninety-Nines, 1983).

During this same period of time a project was being developed that would forge a strong link between the education community and space involvement. This bond was made by the inception of the Teacher in Space program. Christa McAuliffe, a high school teacher from New Hampshire, was chosen to fly aboard the Challenger. President Reagan supported the training of a teacher to go into space on a shuttle mission and teach lessons, via satellite, to children back on earth (NASA, 1983).

However, a tragic event in 1986 had the effect of dampening that interest. The Challenger explosion on January 28, 1986, the very mission carrying the first teacher in space, caused ripples in the space field both educationally and technologically. After watching live television coverage chronicling the loss of seven lives and showing the ultimate vulnerability of
the space program, any complacency the American people felt concerning the "routine" launching of the shuttle was quickly ended (Dewaard & Dewaard, 1988).

The lapse of almost three years between launches of the space shuttle, while NASA struggled with public perception and private sector involvement in the aftermath of the Challenger explosion, caused slow-downs in many other exploration projects waiting for launch space. This has been a cause for concern in technological education during the 1990's (Pallrand, 1989).

Research in Aerospace Education

Content and Curriculum

Many studies in aerospace education have been concerned with teacher training and workshops. Pawelek (1950) conducted a survey study dealing with air-age education at the teacher education level. Letters of inquiry were sent to the 258 member colleges of AACTE along with state departments of education, commercial firms, and other appropriate persons. On the basis of the evidence gathered the following conclusions were made:

1. There was a definitive nationwide interest in aviation education at all levels of instruction.

2. Many prominent educators were concerned with the problem of aviation in relation to teacher training institutions.

3. There was a great deal of vocational literature concerning aviation education but relatively little literature for the practitioner in the realm of teacher education.

4. The industrial population, government, and state departments of
education were active in the publication of air-age education materials.

5. The AACTE had adopted a professional position in favor of and was attempting to assist member colleges with the problem of air-age education.

6. Aviation career opportunities were many and varied with great possibilities for the future.

7. Being able to pilot a plane was a desirable qualification for teachers in aviation education.

8. Teachers of aviation should have ridden in an airplane at some time.

9. The workshop approach was the most advantageous method of offering aviation education to teachers.

10. Technical aspects of aviation should be minimized in favor of the general aspects.

In an attempt to clarify the educational aspects of aviation education it was necessary to define terminology:

Aviation education is that branch of general education concerned with communicating knowledge, skills and attitudes about aviation and its impact upon society. It must be distinguished from that branch of special education known as astronautical education, which is concerned with training specialized aviation workers (Strickler, 1951, p. 162). Having defined the educational parameters of aviation education Strickler (1951) also described his visualization of an Air Center. He explained that it would be a tool, an educational instrument or facility used to facilitate the dissemination of knowledge in aviation education.

Anderson (1955) conducted a survey study of aerospace curricula in eighty-four selected secondary schools across the nation. Basic demographic
information concerning the professional background of aviation education teachers was provided. It was found that: (a) 18 percent of the instructors taught from one to five years at the elementary level, (b) 33 percent reported they had taught from one to five years at the secondary level, (c) 31 percent reported that they had taught six to ten years at the secondary level, (d) 19 percent indicated they had taught more than 15 years at the secondary level, (e) 15 percent reported they had taught from one to five years at the college level, (f) 44 percent held current pilot ratings, (g) 51 percent indicated they had flown as pilots at one time or another, and (h) 57 percent of the instructors indicated they had been members of the CAP.

In a study recommending specific curriculum changes pertaining to aerospace education in-service sessions, Zaharavitz (1959) surveyed fifty-nine individuals who had run summer workshops. The responses from this open-ended questionnaire resulted in the following recommendations, listed in order of importance: (a) basic fundamentals of aviation and aeronautics should be stressed, (b) the workshops needed to include curriculum planning or individual planning of aviation materials for personal use, (c) orientation flights, and (d) field trips. This findings of this study directly paralleled those recommendations made by AACTE (1949).

Falley (1959) undertook an analysis of aviation education programs in Nebraska. Among the results of the study one conclusion was that the acceptance of aviation education was greater in schools where teachers were given the opportunity to participate in aviation education workshops. He also concluded that the enthusiasm and qualifications of the instructors were major factors in the success of an aviation education program.
In order to determine what would be the appropriate content for a college program, Sanders (1967) conducted a study of elementary and secondary school teacher's needs for a general knowledge of aerospace. The results of his study ended in the recommendation of an offering for three college courses: (a) Aerospace Education for Elementary Teachers, (b) Aviation Education for Secondary Teachers, and (c) Space Education for Secondary Teachers. He also recommended field trips to aerospace industries, resource speakers and part-time industrial instructors be utilized for workshops, teacher membership in aerospace education associations and teachers educated in career guidance.

**In-Service Programs and Workshops**

Educators have generally agreed that the three major outcomes of effective in-service programs are changes in teacher's beliefs and attitudes, teacher's instructional practices, and student's learning outcomes (Griffin, 1983). Several studies conducted in the 1970's examined these goals in conjunction with aerospace workshops (Miller, 1972; Romero, 1973; Maupin, 1975; Marcum, 1978).

In a study of the first two workshops in Oklahoma, Miller (1972) sampled 160 subjects to see if the goals of the Oklahoma Aerospace Education Workshops had been accomplished. The goals for the programs were:

1. To stimulate a widespread awareness of aerospace education at all levels of the curriculum.
2. To develop means to stimulate the teacher's interest in aerospace
education.

3. To train teachers and administrators in the application of aerospace education in the schools.

4. To make aerospace education available to students in all grade levels.

5. To encourage closer affiliation between educational institutions and aerospace industries.

6. To train teachers for a specialized course in aviation at the high school level. (Oklahoma Department of Transportation, Undated, p.2).

Miller concluded that all state goals had been successfully met. Further, he made the following recommendations regarding workshop practices: (a) continue the selection of elementary and secondary teachers, (b) continue visits to aircraft industries and NASA installations, (c) provide more small group sessions devoted to special interests, and (d) provide special subject matter to high school teachers, e.g. how to relate aerospace principles to the remainder of the curriculum. This study also recommended that an expanded study be conducted which would include teachers who were not participants in the workshops to determine any difference in attitudes that might have been caused by workshop attendance.

Miller's final recommendation was addressed by Romero (1973). The results of the study confirmed the previous findings of Miller and made further recommendations for the state of Oklahoma. The study recommended that the state continue conducting education workshops for aerospace, continue providing in-service education for the state of Oklahoma, and that the structure of the workshops should remain intact with
increased emphasis on the methodology of teaching aerospace concepts.

Oklahoma State University has generated a plethora of research concerning the state-supported aerospace workshops. Helton (1973) and Marks (1975) focused attention on the workshops in conjunction with materials provided by NASA. Both of these studies recommended the continued use of support with NASA personnel being on site for the workshops and specific educational material being made available to workshop participants. A study by Murphy (1977) reaffirmed some of the findings of Zaharavitz (1959) by looking at specific curriculum content for the workshops. The participants agreed it was necessary that curriculum planning and small group sessions concentrate on personal unit development. Once again involvement by agencies such as the FAA and NASA was confirmed. A descriptive study by Grigsby (1979) was undertaken to determine the status and needs for aerospace education in the schools of Oklahoma. The findings of this study suggested that the greatest needs were workshops for teacher preparation and to establish a position for an aerospace education curriculum specialist in the State Department of Aeronautics.

Tennessee had been a leader in the area of aviation/aerospace education programs (Strickler, 1968). Middle Tennessee State University has instituted undergraduate and graduate degree programs in aerospace education which included extensive work with summer workshops. Brewer (1960) undertook a study to examine the effects of the workshops at Middle Tennessee State University and the University of Tennessee. The greatest growth area for participants appeared to be in the development of social
awareness and the impact of sociological changes being brought about by aviation awareness.

Maupin (1975) investigated the workshops held at Middle Tennessee State University and the University of Memphis during 1972, 1973 and 1974. The findings supported the existence of the workshops and added that 82 percent of the participants who responded expressed the belief that subsequent inservice opportunities would be of value. Ninety-eight percent of the respondents in this particular study agreed that affiliation with aerospace industry and visitations to aerospace installations was a vital part of the workshop content.

Marcum (1978) explored the perceptions of the 1976 workshop participants from Middle Tennessee State University. He also examined the use of aerospace education materials as an alternative curriculum. The information gathered in this study confirmed the previous work by Maupin (1975) and Brewer (1960). The workshops were to be continued with additional emphasis on the teaching of aerospace skills. Maupin and Marcum utilized questionnaires developed by Miller (1972) and expanded upon by Romero (1973). These questionnaires were adapted to the specific goals of the Tennessee program and produced results which could be utilized for comparative purposes by the state and university personnel.

The next published study dealing with the effectiveness of Tennessee workshops was conducted by McKay (1984) and concluded that the participants of aerospace workshops had a significantly more positive perception towards aerospace education than non-participants. This study sampled participants in workshops over the previous ten years and
compared them to a random sampling of teachers from the Metropolitan
Nashville Public Schools.

**Aviation/Aerospace Agencies**

Strickler (1983) stated that the largest number of personnel assigned in
field and facility offices with responsibility for providing services and
resources to the educational systems of the nation were the CAP, FAA, and
NASA. The FAA provided specific training and resource management
programs for individuals who are designated as facilitators in the various
regions of the United States. The FAA took the following position concerning
the training of facilitators:

One premise of the Aviation Education Program is that an informed
citizenry makes better decisions based on knowledge than on ignorance.
The career, political, economic and social implications of aviation
and air transportation are well known to the industry, barely
known by our fellow citizens and perhaps even less understood by
our educators. Thus, where schools want to improve their educational
systems using aviation education, resource persons, in the role of
facilitators, will be available to make a significant contribution (Little,

The interest level in aerospace education was often affected by
economic factors. Budgetary considerations had taken their toll on many
associations and agencies previously in existence for the purpose of
providing aerospace education materials and services (Neal, 1977).
However, the CAP, FAA, and NASA still strongly supported this endeavor by
continually providing materials and man-power as resources for the educator.

Many of the workshop efforts in the United States have adopted, either in-part or whole, the educational goals of these three aviation/aerospace agencies (Dolezal, 1968). Appendix A contains a listing of the stated goals for each of these organizations.

The Young Astronaut Council, created in 1984 by The White House Office of Private Sector Initiatives, through the efforts of former President Reagan (Young Astronaut Council, 1985), is another agency which furnishes information to educators. The Young Astronaut Program is an educational program for elementary and junior high students designed to promote the study of science, mathematics, and space-related subjects. Its primary purpose is to assist in reversing the American student's low proficiency levels in these scientific areas of study. The materials, distributed for a fee after the initiation of a chapter at the local level, aim to foster the interest and skills necessary to live in our technological age.

Concerns for the Relevancy of Present Science Curriculum

The National Commission on Excellence (NCE) presented evidence for dealing with the steady decline of science achievement scores (NCE, 1983). In this report committee member John Hurd concluded that the new generation of Americans had become scientifically and technologically illiterate.

The report by NCE proposed recommendations to be implemented during the next several years. The first recommendation concerned
curriculum content. State and local high school graduation requirements should be strengthened: students seeking diplomas would be required to take four years of English; three years of mathematics, science, and social studies; and one-half year of computer science. The second formal recommendation covered standards and expectations. All schools were charged to adopt more rigorous standards for academic performance and student conduct. It was further recommended that these reforms begin at an early level so that an appropriate foundation might be present for continued future success (NCE, 1983).

John Zinman (1980) recommended that scholars develop more engaging science programs for elementary and secondary students, using the term science/technology/science (STS) to guide their efforts. He argued that teachers should promote student involvement by posing questions and problems relevant for the students. This same concern with the relevancy of science was voiced by Yager and Penick (1987). They indicated that studies done over the years have supported the belief that students do not enjoy the subject of science or see the relevancy for its study in their lives. Further, it was explained that many teachers believed students expected the subject to be difficult and therefore uninteresting.

A hands-on approach to science education was advocated by Jones & Piper (1975). They believed this approach helped involve the child in inquiry and self-directed learning. This type of knowledge acquisition made subject matter relevant and more understandable for each child. Shymansky, Kyle, and Alport (1982) also conducted a study investigating the hands-on approach to science teaching. Their findings suggested that
children involved in such programs liked them because of the direct involvement. Beyond the aspect of enjoyment, data from review of test results showed that children in these programs scored at least 18 percentile points higher than traditional class students on measures of process skills, including observation, inferences, data interpretation, hypothesizing and graphing; and that students in hands-on programs scored from four to eight percentile points higher than students in comparable textbook based programs on tests of reading and arithmetic skills.

In 1976 Harlan stressed that science concepts should be built slowly from simple facts into unifying ideas. Emphasis on the integration of the topics with other school subjects was recommended. This integrated curriculum process was echoed by Duca (1985) in a study concerning the integration of aerospace education into the core curriculum of the Denver public schools. The findings indicated that the importance and relevance of the aerospace era made more of an impact on the learner when the information was related to all aspects of living.

Fishback (1968) recommended a similar integrated curriculum. Findings asserted that regular course offerings acquire new and more relevant meaning when supplemented with pertinent aerospace facts. These same pertinent fundamentals of aerospace were already major factors in many general study units, such as "Living and Working Together", "Communicating Ideas", "Exploring the Universe", and so forth. This approach was affirmed by Gagne (1962) who believed that aeronautical subject matter could be used to arouse the interest of otherwise apathetic students in areas not traditionally related to aviation.
Yager (1988) asserted that "science education for all that it implies must be useful for all" (p. 54). The study of science needed to provide for a sense of logic and imagination with a relevance to the life of the student.

**Aerospace Education in the State of Texas**

**Research Background**

In researching aerospace education in the state of Texas little formally published educational information appeared. Of the dissertations on aerospace/aviation attributed to Texas universities, only one study contained information pertinent to the topic of aerospace education (Dolezal, 1968).

Wilma Dolezal (1968) began an extensive analysis of aerospace education in Texas. The study analyzed the status of aerospace education in the schools and colleges of the state, studied a specific program integrated into the school science curriculum, and evaluated an aerospace education workshop system at a selected university. The work also analyzed programs in three specific high schools.

In examining the personal files of the college instructor responsible for leading the workshop sessions, Dolezal (1968) found information pertinent to sessions from 1960 through 1966. Rating the workshops on a percentage basis she found that there was overwhelming agreement that the workshops be continued. Participants in 1960 were 94 percent in favor of continuation while the participants from the five following workshops were 100 percent in favor. She also found that the university selected for the study was involved with sponsoring, on average, thirteen in-service sessions per year in a joint effort with nearby school systems. A listing of workshop and
in-service programs held in 28 universities and public school systems was included, covering the years from 1959 through 1968. Texas A & M University, East Texas State University, Texas Wesleyan College, and the Corpus Christi Independent School District were among the most active.

Dolezal (1968) also discussed specific goals for the workshop that was studied. It was stated that the few goals the instructor did list were very similar to those adopted by the CAP education program. The study also indicated that the development of the workshop was heavily influenced by the interest level of the instructor.

The interaction of several factors was identified as cause for success or failure of aerospace programs in the state of Texas. The following were cited as being responsible for a lack of interest in aerospace education:

1. Overcrowded curriculum
2. Failure of the program to be certified by the state education course certification body as a regular course carrying a credit acceptable for college admission.
3. Lack of interest among teachers and administrators.
4. Lack of qualified instructors.
5. Lack of funds.

State Department of Education Policy Bulletins

Bulletin No. 448, 1945

Bulletin No. 448 was published by the Texas State Department of
Education under the direction of Hob Gray (1945) as Editor and consultant. The bulletin began with a letter written by then State Superintendent, L. A. Woods. In that letter Woods outlined his own beliefs about the integration of aviation materials into the state curriculum. He asserted that the school systems should use aviation instruction to emphasize primarily the cultural, pre-vocational, and avocational phases with secondary emphasis on the vocational aspects.

The material in this bulletin was a direct outcome of a conference on aviation education held in Ft. Worth in November of 1944. The bulletin contained sections of information concerning: (a) non-school aviation education agencies, (b) aviation education in the elementary schools, (c) aviation education in the junior high schools, (d) aviation education in the secondary schools, (e) aviation education as enrichment, (f) courses in aeronautics in the secondary curriculum, (g) aviation training in Texas junior colleges, (h) preparation of teachers in aviation education, (i) aviation training in Texas evening schools, (j) a bibliography of aviation education materials, and (k) a list of film sources (Gray, 1945).

The bulletin maintained that if the recommended programs were to be carried out properly, with the visions of the conference intact, both prospective and veteran teachers must be trained accordingly. Colleges were charged to offer training courses, although the verbage made it clear that there may well have been some uninterested universities. Those interested institutions were given three guidelines to follow in setting up programs:

1. Curriculum should contain a large segment devoted to the implications of the impact of the airplane on society.
2. Curriculum should contain a section dealing in non-technical language with the science of aviation.

3. Curriculum should involve laboratory experiences designed to acquaint the student with some of the basic principles of aeronautics and field trips should be utilized. (Gray, 1945, p. 55).

Veteran teachers at all levels of instruction were given several options in securing additional training in aviation education. Included were committee reports at faculty meetings, summer school courses and university or college extension services, State Department of Education sponsored conferences, governmentally sponsored workshops and consultant services, programs offered by educational associations, and utilization of the services of airlines and aircraft manufacturers.

Material in the bulletin covered curriculum areas from elementary through post-secondary vocational training. The bulletin offered this advice in reference to the introduction of aviation education programs in the elementary grades:

Individually the elementary school child needs to be introduced to the air-age by means of a planned program of education in the class rooms. This should be done from month to month and from year to year and not through brief periods of intensive instruction spaced at long intervals. The air age, its importance and implications, can be brought in with mathematics, sciences, social studies, and almost every other subject taught (Gray, 1945, p. 9).

The bibliography included in this early bulletin divided material into curriculum areas: language arts, arts, science and mathematics, social studies,
english, geography, industrial arts, biology, physics, and general texts were specifically listed. There were further divisions for elementary; labeled as primary, intermediate and upper-elementary, and secondary; including junior high and high school. Material included a wide range of subjects from technical writing to incidental story-reading sources (Gray, 1945).


Texas Education Agency (TEA) Bulletin No. 712 (1971) was written as a result of recommendations made by the Texas Aerospace Education Council (TAEC), which was established in 1968. In 1976 this council was reorganized into the Texas Advisory Council on Aerospace-Aviation Education to conform to State Board of Education policies for advisory committees. TEA published the revision to Bulletin 712 in 1978 (TEA, 1978).

The term, aerospace-aviation education, was coined by TAEC in 1968 in a bulletin on science education (TEA, 1968), continued in the 1971 bulletin (TEA, 1971), and used again in the 1978 version (TEA, 1978). This revision stated a philosophy which utilized one, or a combination of four, approaches to presentation of aerospace-aviation education programs (TEA, 1978).

Information in Bulletin 712 (TEA, 1978) proposed four separate courses of study. Each had the following specific stated objectives and goals:

1. The objectives for General Aerospace Education were for students to develop skills, knowledge, and attitudes about aerospace activities and to become aware of the total impact of this realm on society. The goal was understanding of aerospace technology, regardless of their chosen vocation.

2. The Multidisciplinary Approach sought to integrate study units into
the existing traditional course offerings. Topics included had relationships with existing offerings. The bulletin explained that this approach was a natural motivator for many students.

3. The Career Education Application area provided for an investigative atmosphere in order to provide students with a preview and foundation of skills, knowledge, and attitudes upon which to base determination about future educational pursuits and further define and refine specific career possibilities.

4. Occupational Education and Technology was an approach where a class might actually construct an airplane. This phase contended that even though the formal educational process might end at the completion of the secondary level, the skills attained there helped provide entry level preparation of the student for employment in the aviation-aerospace industry.

Curriculum was divided into four certified areas labeled as Aerospace-Aviation I, II, III and IV. All grade placement began at tenth grade. There was no mention of the elementary or junior high school level in this bulletin (TEA, 1978).

Teacher qualifications listed in this bulletin were established under accreditation rather than under certification. The teacher had to hold a valid secondary certificate with any one of the following:

1. A valid FAA Private Pilot Certificate (or higher)
2. A valid FAA Basic Ground School Instructor Certificate (or higher)
3. Have earned six semester hours in an aerospace-aviation course or workshop or equivalent courses in space sciences, such as
meteorology or aero-dynamics of flight (TEA, 1978, p. 3).

These prerequisites would allow certified teaching in Aerospace I, IIA and IIB courses. In order to teach Aerospace III, IVA or IVB the teacher needed to have had actual operational experience in air traffic control or to have acted as a required flight crew member.

**Legislation**

**House Bill 246, 1981**

In 1981, in an attempt to improve student achievement, the curriculum of the state of Texas was upgraded by specific mandates from the 67th Legislature. The Legislature amended the Texas Education Code through House Bill 246 (1981). This bill required that a standard, well balanced curriculum, including science, be taught across the state. These changes furthered the integration of aerospace education programs into the area of science education.

**Title 19, Chapter 75**

To implement the law, the State Board of Education called upon educators, policymakers, and the public in order to identify the essential elements of the subject areas that were specified by this law. Title 19, Chapter 75 of the Texas Administrative Code (1984) contained the Essential Elements approved by the Board in 1984. At this time all advisory boards for the state were abandoned.

As in the 1971-1978 curricular changes, Aerospace-Aviation Education was listed only for the secondary level. Some of the Essential Elements listed
in the TEA science framework guidebook (TEA, 1987) for elementary science might be used in conjunction with appropriate aerospace education units. However, there was no specific listing of Essential Elements pertaining to aerospace education in the planning publication.

Summary

Aerospace education programs have had a long history of support from the business, educational, and governmental communities. The use of aerospace information within the curriculum has been advocated by the state of Texas since 1942, beginning with an integrated approach for use in all subjects, to presently being a part of the science education program. Science education programs have come under fire in questioning their relevancy for the larger population of students.

Research has shown that introduction of pertinent information has been facilitated by the use of aerospace education workshops for teachers. The effect that these workshops have on the practices and attitudes of the teachers involved has been extensively researched by several states. Texas has not had a formal study of the outcomes of aerospace education workshops since 1968.
A qualitative approach was selected for this study. Qualitative research is a generic term for investigative methodologies which include field research, participant-observer interaction, ethnographic work, factors of an anthropological nature, and naturalistic interpretation (Jacob, 1987, 1988).

Each of these methodologies can be used as a single type of qualitative research instrument, however, when used in combination, the complimentary aspects of the approach are evident. Qualitative methodology provides a means of gathering a broad range and variety of types of data, then allows for the study of the interrelationships among that data. The procedure also focuses the researcher's attention on organizing the diverse and interrelated data gathered into a meaningful whole (Stainback & Stainback, 1988).

Theory development in qualitative research is most closely aligned with the use of sociological and anthropological data collection, as opposed to theory development in quantitative research where it is sometimes restricted to a systematically stated and testable set of propositions. According to Bogdan and Biklen (1982), a theory, for qualitative purposes, is a loose collection of logically held-together assumptions, propositions, or concepts that orient the research and thinking.

According to Goetz and LeCompte (1984), the most common means of
data collection is participant observation. "The types of participant observation generally identified are tied directly to the researcher's degree of involvement in the setting being studied" (Stainback & Stainback, 1988, p. 50). Spradley (1980) divided types of participation into five categories: (a) nonparticipation, (b) passive participation, (c) moderate participation, (d) active participation, and (e) complete participation.

When observation is used in conjunction with interviewing, the researcher has the opportunity to study the relationship between the actions of the subjects and their words. The goal of the interview is to let the subjects discuss issues important to them and cover points of importance in a manner which enables the participants to use their own words and concepts (Stainback & Stainback, 1988). The interview may be unstructured or minimally structured to facilitate this flow of ideas. The interview session may be more formal or structured if the researcher must address specific topics, such as demographic information necessary to the total ethnographic work.

An important step in utilizing the information gained during observation and interview comes with the analysis of the researcher's fieldnotes. Fieldnotes are a written record noting what the researcher has seen and heard in the field and the feelings, thoughts, and reactions associated with the events (Stainback & Stainback, 1988).

In addition to what they say and how they behave, human beings also make and use various artifacts. Anthropological information and demographic material reveals characteristics of the group under investigation that provide a framework for the baseline data (Goetz & LeCompte, 1984).
The specific artifacts involved in the educational setting may include textbooks, curriculum guides, and lesson plans.

The naturalistic interpretation involves the analysis of the data the researcher has collected. An in-depth analysis begins by working with the data, organizing it, breaking it down into manageable categories, searching for patterns, and looking for consistencies and inconsistencies. Bogdan and Biklen (1982) define the specific in-depth analysis or examination of one setting or a single subject as a case study. The case study approach is compatible for use in an investigation to determine the materials, practices, and perceptions associated with the teaching of aerospace education by teachers who have attended an aerospace education workshop.

A qualitative approach was chosen for this study for the following reasons:

1. The goal of the analysis was an increased understanding concerning the choice of materials, methods, and teacher perceptions associated with teaching aerospace concepts.
2. A case study approach was appropriate due to the detailed nature of the data that was collected.
3. Data included fieldnotes from observations, transcripts, and fieldnotes from interviews with teachers, administrators; including the principals, a magnet science and math coordinator, and the elementary science coordinator, and an analysis of lesson plans, curriculum guides, textbooks, and state mandates; both for Essential Elements and Textbook selection guidelines. These required qualitative methods of analysis.
4. Specification of an a priori hypothesis was inappropriate because of the use of the grounded theory approach for data analysis (Glaser & Strauss, 1967).

Population

The four subjects of this study were employed as elementary teachers in a single north Texas metropolitan school district. They were chosen from among a group of teachers who attended a summer aerospace workshop. (See Appendix B for a description of the workshop). The teachers, given pseudonyms for reporting purposes, were assigned to three different elementary buildings, one of which was a magnet school setting. One of the subjects had been given a new teaching assignment which removed her from a regular classroom setting. For data collection purposes, she and her principal were interviewed, but no classroom observations were conducted.

Also included in the study were the building principals for each subject, the magnet science and math coordinator for two of the subjects, and the district science coordinator.

Procedures for Data Collection

This study was conducted in a metropolitan school district in north Texas. Permission was obtained for the researcher to observe and interview four elementary education teachers during the fall semester of 1989. The teachers and administrators were told that the researcher was interested in observing elementary science instruction and other subjects where science might be integrated into the curriculum. The administrator in charge of
research within the district had been given full details of the study. He agreed not to share these details with anyone within the district.

Initial contact with the teachers was made in October, 1989, to put them at ease with the researcher and to assure them that the observations were not evaluative in nature. At this time, it was discovered that one of the subjects had been reassigned to a position which did not include regular, core subject, teaching duties in a traditional classroom setting. After discussion with committee members, it was decided to include only interview information from this teacher, and her principal, concerning the previous year's classroom teaching.

During the first interview demographic information concerning personal data, educational background, and any pertinent information concerning their classroom setting was collected. During this interview, bulletin boards, learning centers, hallway displays, library centers, storage areas, and classroom set-up was noted by the researcher since science and aerospace concepts may be integrated into other curriculum areas. Each time the researcher was in the building to make contact with the teacher updated field notes were made.

Fieldnotes were taken during the observations. The notes contained a description of the physical setting, a commentary concerning the progress of the lesson, and reflective comments from the researcher during and at the end of each observed session. Taped interviews were scheduled with the teacher as soon as possible following each observation. The same progression was followed for each subsequent observation/interview that became necessary.
Taped interviews were scheduled with the principal, magnet science and math coordinator and the elementary science coordinator. These interviews gathered data concerning their observations about the teachers during science instruction. Information about their knowledge concerning the use of aerospace education materials by the teacher and their specific views about aerospace education in general were asked directly, if they had made no mention of them during the interview.

In addition to the observations and interview, materials such as lesson plans and enhancement materials were reviewed by the researcher. This inspection of documents, used in conjunction with the classroom observations and interviews with administrators and teachers, provided for a process of triangulation to facilitate the corroboration of the qualitative research findings.

Concluding interviews were scheduled with each teacher following formal classroom data collection. At this time the teachers were queried concerning specific beliefs about aerospace education, agencies where materials had been obtained, feelings about support of administrators for their classroom activities, and beliefs about the benefits of, and recommendations for, the aerospace workshop previously attended.

**Data Analysis**

The constant comparative strategy of data analysis was utilized (Bogdan & Biklan, 1982; Glaser, 1978; Stainback & Stainback, 1988). This comparative method was utilized throughout the data collection period.

Data were collected through the outlined processes, then analyzed to
determine categories, patterns, consistencies, and inconsistencies. Once patterns began to appear, these were sorted and compared to determine subsequent relationships. Material collected throughout the process had a bearing on the direction the research took. The process developed a theory which was constantly revised during this period of time. This same iterative process was used for data analysis involving observation and interview with teachers, analysis of written material, and interviews with administration.

The final phase of analysis occurred when all data had been collected. Data on the individual teachers were compared to detail similarities and differences, then the remainder of the data were added so that comparisons might be made in determining existing relationships to the subject.
CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

This study was conducted in a large school system in north Texas. The data collection period covered the fall semester, specifically from October, 1989, through January, 1990. The subjects, their respective schools, and the administrators interviewed were given pseudonyms for reporting purposes.

The results from the case study are presented in six sections. The first three sections are delineated by the subject's respective elementary school buildings (3). These sections contain information regarding each of the four subjects, two of whom were in the same building. The information is related to school population descriptions, subject profiles, observations and interviews for each subject, lesson planbooks, and interviews with each building administrator. In the case of one building an interview with the science and math coordinator is also included. The fourth section contains information related to an interview with the district science coordinator and pertinent information regarding district and state policy for the science curriculum. Outlines of the textbook series, which was a district-wide adoption and used by all the subjects, are included in Appendix B.

In this chapter, where a division is noted by "Transcript", the discussion which follows is a verbatim accounting from a transcribed audio-tape. In these instances corrections have not been made for grammar usage or sentence construction. Punctuation has been added, where appropriate, to
help clarify the conversation.

The fifth section contains an analysis of the data, in relation to the six research questions. Section six contains information related to subject demographics. These sections contain several tables of related information.

School A

School A is where observations for two of the subjects, Norma and Paula, occurred. This is a neighborhood school in a lower-middle to lower socio-economic area, however, busing is still provided for those students living a specified distance from the building. The administration at this school consists of a principal and a full-time vice-principal. In addition to the typical kindergarten through sixth grade setting, this building houses a science and math magnet school setting. This program is designed for children, both from this district and out-lying districts, with specific interests in math and science and who qualify academically under the set guidelines from the district. Others who are attending from outside the district must pay a tuition fee. The magnet school deals with students in the second through the fifth grades and teaches a total curriculum which is expanded with math and science emphasis.

Norma

Norma was in her early forties and possessed a Bachelor's Degree in Elementary Education. She was extremely involved in faculty in-service opportunities, both as an instructor and as a participant. She was one of three second grade teachers in a specialized math and science program. This
was her fifth year of teaching, in this particular setting.

October 19

Phone Conversation: Researcher introduced herself and let Norma know she was going to be doing observations in science, and possibly in another subject, to look for activities related to science instruction. The researcher asked if she would consider participating in the study. Norma responded in the affirmative. She expressed interest in being involved in a science project that would include direct classroom observation and added that she had not read any work where this had been accomplished. She asked if there were any special things that might needed or must be available in the classroom. The researcher informed her that there was no special treatment required. The researcher told her that she would call back the next week so that Norma could look at her existing schedule and see if they could fit in time for an initial interview of 45 minutes to an hour.

October 24

Phone Conversation: The conversation related to setting a time that would be appropriate for the initial interview. Norma was going to be involved in in-service training for another school. She stated that she was conducting a Young Astronauts program and would not be available until the next week. The interview was scheduled for November 1, during her planning period.

November 1

Classroom Set-up: There were five tables with four chairs at each table.
Bulletin Boards and Wall Displays (Teacher Made): There were several aerospace-related posters up on the classroom walls. There was a "First American in Space" poster behind the teacher's desk. There was a poster relating to the building of space stations. The Birthday Chart, at the entrance to the classroom, was illustrated with an airplane and each child's name was on a cloud.

Bulletin Boards and Wall Displays (Student Made): None related to aerospace are noted.

Learning Centers: The reading center was set up around a rocket poster which said, "Space Library", "There's always space for reading." There was a table below the poster with three chairs at the table.

Visual Aids: None related to aerospace were noted at this time.

Storage Cabinets or Bookcases: There were several bookcases behind the teacher's desk. On this bookcase there were some patches and decals for the "Teacher in Space" program. On a storage cabinet, on the opposite side of the room, there were several open tray-like containers with labels which indicated the contents. Some of the labels indicated contents for "NASA" materials, "Aerospace Guide", "CAP", specifically, then others referred to several unrelated subjects. There were also some trays containing materials which were not labeled. There were several other closed cabinets.

Classroom Observation: These observations were made at the end of the teaching day. No children were present in the classroom.

Transcript: Initial interview.

Researcher: Tell me a little bit about the curriculum. Are there any specific things of which I ought to be aware?
Norma: Animals is what we're working on now. That will probably extend into all of November and maybe even the first week of December.

Researcher: OK.

Norma: Do you need to know what comes after that?

Researcher: Do you know what comes after that?

Norma: I can tell you. We don't follow the book sequentially because we like to fit in the zoo and that kind of thing early in the year. We like to do weather first and so we don't do it sequentially.

Researcher: So you've already done weather?

Norma: The next one would be sound and light. There are some really neat things in there.

Researcher: Yes, there seems to be lots to work with there.

Norma: So, you know, then that would fall at the beginning of December.

Researcher: All right that gives me a good idea for the schedule. I would like to be able to take a look at the textbooks and guides during that time, too, if you don't mind.

Norma: Oh sure, sure, that's no problem. I've got a lot of extra materials. You know that this is also a program for able learners and so we enrich what we have from the district anyway. We expand it and broaden it so I have a lot of material for each unit and you're welcome to see all that, too.

Researcher: How many second grades are there and are you all together in this building?
Norma: Yes, we're together. In this part of the building there are three.

Researcher: Do you work together?

Norma: Somewhat. We are self-contained, so we work really independent of each other. We do do some planning together, but we definitely have control over what goes on in our classroom. Such as what extra things we want to add to what we might have to cover.

Researcher: Give me a little background on your education.

Norma: I grew up in south central Texas and went to school all through high school in the same little town. I attended [area university] in [city name], which is my hometown. I have a Bachelor's Degree in Elementary with a specialization in English. The first year after college I taught kindergarten in [my hometown] for a year. Then my husband got a job at NASA outside of [specific city], so we moved down there and I taught first grade in [specific school] District. While I was there I became really interested in early childhood more than I had been before so I started graduate school at the [university in that city]. I developed a preschool program for a group of friends at a church who were starting a preschool, three and four-year-old program. I worked there for a year and a half, developed curriculum, and developed that program. My husband found a different job up here in [present city], so he moved first. Then I moved and I had to give up my early childhood graduate work because when we moved up here I wasn't really interested in driving to [specific city name]. There was no other place up here. There were only three other places that offered it at the time, so I just kind of gave up on it. So I went to [Area
Univeristy A] and did graduate work in reading, as a specialty, and I taught in a parochial school for three years. Then I stopped and had a child. When she was three I went back to the same parochial school and taught first and second grade. After a year of being back I decided I was still interested in little kids, so I went back to the preschool at our church and taught four-year-olds three days a week. Then I quit completely for a few years because I was really enjoying having my child at home and I knew she was quickly going to be going to school. So, I quit and I home-taught her kindergarten. Then, when she went to first grade, I started working at the mothers day out program at our church. When she was in second grade she was having school problems at our neighborhood school because she was frustrated. She just wasn’t being challenged. So we found this magnet program in the newspaper and it was the first year it was going to open. Second and third grade was what opened that year. So, even though we were out-of-district we applied for her to go to it. She was accepted and I worked as a volunteer that year that she was in third grade. I also got to know the teachers and was encouraged to apply because there were going to be new openings when they opened up the fourth grade. I did apply and a second grade teacher retired that year, so I was hired for second grade. This is my fifth year here.

Researcher: Have you taught above second grade?
Norma: Yes, I taught above second grade in summer enrichment programs and in a Young Astronaut program at a private school.
Researcher: What age level is that?
Norma: That would go all the way through seventh. I still have a Young Astronaut program at one of the private schools. We'll start meeting next week every Thursday afternoon. That will be third through sixth grade. Then in the summer one of the other teachers here and I do a summer enrichment program as a space camp. We've done it for four years with this year. We've done the program at [nearby district.] We do a full day camp for two weeks. Last year [present city] asked us to do one for them in their summer enrichment series. We did it half-days for two weeks with kids from, I think it was like second through sixth, for them. I've worked with other ages, but I prefer this age level for daily work.... Even though I'm not particularly comfortable with the older ones, the multi-age groups in the summer programs are neat because I think it really does help to enrich you too. Since I've been in this program we've also had many courses opened up to us through the gifted education department and just through this program so I've taken 16 or 18 graduate hours in science now and three in math.

Researcher: My next question is really hypothetical. If you had a choice of subject matter to teach, do you have a preference?

Norma: I would really like to departmentalize and do math and science. It's really exciting. Everybody learns how to teach reading and loves it. At one time I really loved it, but it's not what I love anymore. It's just one of the things that has to be taught so you can have them read in the science book and in the math book. But then too, the children in this program are able learners and come to us a lot of times already reading. They can be encouraged to read some of those extra non-fiction things.
November 10

**Classroom Set-up:** There were five tables with four students sitting at each grouping. Children's names were displayed above each table grouping with apple mobiles. One large apple, hanging in the middle of the classroom, said, "You Are the Apple of My Eye". Hanging from it was a Young Astronaut Program patch.

**Bulletin Boards and Wall Displays (Teacher Made):** "The History of Aerospace" was the heading given to a poster of "The First American In Space". A poster beside it said, "What does it take to do a Big Job in Space?" with several examples of what materials might be used to work with in space. On another wall, and noted as being a new addition since the previous visit, there was a large computer made banner, "Living and Working in Space--May Be in Your Future". Information posters about space stations were placed underneath the banner, one of which was entitled "USA in Space". On an adjacent wall there was a display of teacher-made sentence strips which outlined job titles for Flight Chief, Mission Specialist Materials, Maintenance Specialist, Data Specialist, and Communications Officer. These were displayed above a chart which had the children's names written on it. This ready-made chart was decorated with pictures of imaginative space characters. The happy birthday chart, which was by the classroom entrance, was illustrated with an airplane flying through clouds. The clouds contained the names of the children. There was a set of balloons, all in various stages of collapse, hanging on wall by the light switch, which asked a question about retention time for the air inside the balloons.
Bulletin Boards and Wall Displays (Student Made): This refers to additions to the "Teacher Made" space station bulletin board. In front of the banner was a large bulletin board which said, "Look at Our Space Stations". Each child had developed a picture of what their space station would look like. These were displayed in random order on the large background bulletin board.

Learning Centers: The reading center was decorated with a large chart on the wall which was shaped like a rocket with the title, "Space Library" as a heading and a sub-heading of "There's always space for reading". Under it was a chart headed, "Space Explorers" which was a pictorial listing of all the astronauts in NASA's space program. Another poster in this center stated, "Read about Aviation and Space" which charted the evolution and history of flight by pictorially illustrating the development of different aircraft since early ballooning. There was a table under the chart with three chairs around it. Several magazines and various books were on the table.

Visual Aids: On top of one of the bookcases there were several airplanes along with a model rocket launcher. Among the models the researcher noted a Cessna plastic demonstration model, a shuttle launch platform, several styro-flyers, a Delta Dart, a United Parcel Service demonstration airplane, an American Airlines DC-9 model and three folded paper airplanes. On another table, on the far side of the room from the researcher, there was a large professional demonstration model of a space shuttle orbiter.

Classroom Observation: The classroom was observed during the regular science period. The lesson centered around the study of birds. The class was
working in cooperative groups to develop a model of the nesting habitat for various birds. The only relevant reference to aerospace was made by the teacher, when she referred to the children by their shuttle mission crew names. The terminology was more fully explained in the transcript from the post-observation conference, which occurred the following day.

November 10

Post-Observation Conference: The conversation began with a discussion concerning group selection and classroom dynamics as it related to working in the group setting. Where questions arose during the observation itself, the researcher asked the teacher direct questions for explanation.

Transcript of Conference:
Researcher: Tell me about the term Mission Specialist. As I was looking around the room, I saw your listing here. What significance does that listing have for the class? They reacted very consistently to the terminology.
Norma: Of course aerospace is my interest and so I've worked with small groups for many years but I've never been happy with the titles. When we did our space camp we really sat down and did some thinking about how groups might work better. What kind of people do go on a space shuttle and what their functions were that might go with small group work. What titles and what does that mean and what would we ask the children to do. In fact let me show you this.

[At this point the teacher went over to an open bookcase and got a binder to bring over for the researcher to examine. The binder contained lesson plans]
and curriculum about how to set up a management system for the children to use during a space camp setting.]

Norma: This is what I developed for a workshop that I gave for some teachers in the summer out at the space camp. I developed what I wanted them to do. This is how we started our study. I took some of this from other materials. This is not all just my doing, but I took what I thought was the best of a couple of ideas of what good group management was. Mission Specialist is just one of the names that is given to a crew member of the space shuttle. In another group you might call that a materials officer or something else.

Researcher: Do they get to rotate these jobs as well?

Norma: Those rotate every week. You can see that chart [indicates the chart on the wall that was noted by the researcher in the classroom notes] it's set up all the way through December. . . . Their responsibility for the week is to come in on Monday and see what their job is and go review what the functions of that job are, so they can carry it out for their group. Then we pass out the stickers just to help remind them, and me, so I can just look around and see. [Each child had a name tag with a color coded sticker which corresponded to the color sentence strip that the job title has been written on].

Researcher: They seemed to have a good sense of direction and responsibility for what their jobs were. The groups accomplished what they set out to do.

Norma: I think they can learn that. I really do. I'm teaching a workshop after school for teachers in using hands-on science techniques
and if you can get over the initial confusion of letting them have extra freedoms and yet set the system up with enough clarity, I really think it adds a lot to their process of discovery and exploration. I've done this work informally since I've taught, but the more I've actually studied it and lived, I realize that it's a skill we really need. You can withdraw from being a part of a group and do nothing or you can participate. If you don't have these skills when you're growing up where are they going to come from? It's very much a life skill to be a part of a crew setting and accomplish a goal together. This is just one means of introducing them to it and being consistent with the job setting.

Researcher: The application is important. You answered my question there with the committee work. What about the terminology? Where the child used the term simulation. Is that something that comes from the science material?

Norma: That came from the supplementary science material that I was using. That's the first time I've ever used that term in second grade. Last year we used pretend or imitation and those kinds of words. The materials said that children need to realize that there are many activities that you would like to do, but you just physically can't do them, so simulation is the next best thing. So, I just thought we'll use that word and see what happens. Now they are using it appropriately without prompting on my part.

Researcher: Well the child that used it for you seemed rather matter-of-fact about it... I did wonder if it was something that specifically came from the text or whether it was supplementary.
Norma: Right. It was supplementary. We purchase, or at least I do and I know that others do. We really purchase a lot of supplementary materials because I think there were only three pages on birds. That's fine. There are pictures and a little bit of writing but we just feel that it needs to be more.

Researcher: You extend it. Do you have any process that you have to go through to okay any supplementary material?

Norma: No.

Researcher: OK, then it's pretty much teacher judgement.

Norma: Yes, I think that sometimes we take ideas past the coordinator, or talk about them among ourselves. That's always a good way of checking because it gives you something. People will tell you. I think we all feel pretty free to say like "oh that doesn't sound right" or "that's not as good a way" or "did you think about this". In this program we pretty much are open to that. Not as much as I'd like, but I think bouncing your ideas off other teachers is a pretty good way. It keeps you from making big mistakes because sometimes you just don't think.

Researcher: Sometimes the value of someone else's expertise or where they've been.

Norma: Right. If it's a special project or a big project, I think we all at least take them past the coordinator to see if there would be anything that she would think would not be good.

Researcher: I have another question. About the experiment by the door on the balloons, was that a specific unit?

Norma: That was in our air and in our weather unit. What we did was
in this unit every year we have a fund raiser, where they do a balloon launch. So the days they introduce that, a P.T.A. mom comes in and introduces it. The morning she came in they had a million questions. One of them was could a helium balloon lift a child. What if? What if? They were all what if. It was like when one person said what if, everyone said what if, and so I said what if we had a helium balloon what could we try to lift and they finally came up with a paper clip. So when they were filling the balloons for the launch I asked them to fill one for each of my groups. Then they experimented to see how many paper clips they could actually get off the ground without it anchoring. Of course there were so many variables; the different sizes and kinds of the balloons etc. so it was just very interesting. That was Friday so by Monday they were all anchored to the floor by the paper clips. We just decided to hang them up by the door to see how much more helium they might lose. We related it to some of the hot air balloons that we saw during some of the balloon activities in the area, that sort of thing.

November 17

Conference for Examination of Materials: At this meeting the researcher did not do any direct observation or have any recorded conversation with the teacher. The purpose of this visit was to enable the researcher to examine the lesson planbook and to look at the district-wide adopted science textbook (See Appendix C).
Bulletin Boards and Wall Displays (Teacher Made): There was a list of vocabulary words on the chalkboard, which was under the heading of spelling. Among the words listed were: atmosphere, air, and astronaut.

Bulletin Boards and Wall Displays (Student Made): The bulletin board dealing with the space station had been expanded. Each child had written a short narrative which was placed along side their drawing. The stories explained what was in their picture and how they thought it might be utilized by the people who would live in the space station.

Learning Centers: No new centers were noted.

Visual Aids: A few more models had been added to the ones previously noted. They included some additional paper airplanes and a Delta jet plastic model.

Storage Cabinets and Bookcases: No changes were noted.

November 28

Scheduling Conference: The researcher made direct contact with the teacher to check on scheduling for December. The researcher wanted to make sure that an observation would not interfere with any special programs for Christmas.

Classroom Set-up: The set-up had not changed since the last visit.

Bulletin Boards and Wall Displays (Teacher Made): The posters behind the teachers desk had been changed. They still related to the history of aerospace, but they featured different people.

Bulletin Boards and Wall Displays (Student Made): The narratives had been taken down from the space station bulletin board. Other stories had
been added around the posters which explained the main space station in the largest poster. These seemed to be reactions to U.S. involvement in space, not just their personal interpretations of the space stations that they had originally designed.

**Learning Centers:** No new centers were noted.

**Visual Aids:** No new aids were noted.

**Storage Cabinets and Bookcases:** No changes were noted.

**December 7**

**Scheduling Conference:** The researcher made contact with the teacher to check lesson plans and schedule an observation in another subject area. It was decided that because of testing and the coming holiday season, with the vacation beginning the next week, that observations would be continued after the Christmas holidays.

The researcher did not observe any changes in the classroom.

**January 2**

**Scheduling Conference:** This date was the first day back from vacation for the teacher and the classroom. The researcher stopped to see the teacher during her regularly scheduled breaktime. After checking lesson plans, the researcher noted nothing special pertaining to aerospace. However, because some of the material from the bulletin boards had been done during Language Arts time previously, it was decided that the researcher would observe during this time period. The researcher and the teacher agreed that the observation would occur during one morning early that week, however,
the teacher was not specifically informed of the subject time period.

The consultation with the teacher was held in the teacher's study area. The researcher did not have an opportunity to review the classroom setting for any changes.

January 4

Classroom Set-up: The children's desks were in the same configuration as in previous visits, however, the children had rotated positions at the various tables. They each still wore the color-coded name tags for the management system.

Bulletin Boards and Wall Displays: There was a new bulletin board titled "My View of the World". On a wall opposite this display there was an original NASA poster which showed this same view of the earth. The space station bulletin board was down. The only things which remained were the NASA space station posters and the banner caption. The "History of Aerospace" poster, usually displayed by the teacher's desk, had changed from the poster noted before Christmas vacation. A "Great American Explorer Contest" poster, sponsored by the Scholastic Book Company, was displayed on a bookcase back. Two of the ten explorers profiled were aviation or space personalities: Amelia Earhart and Neil Armstrong.


Bulletin Boards and Wall Displays (Student Made): The children also had input on the "My View of the World" display. It consisted of pictures of the earth drawn from a view point in space. Each child had drawn an
"earth", however, the display did not appear to be finished.

**Learning Centers:** Two large containers of books were under one of the tables. All the titles that the researcher observed were related to aerospace. As the researcher came in to the classroom, two children were discussing the range of sounds they could produce for each category listed on the chalkboard, illustrating sound categories. They were discussing what the differences between a jet, a regular airplane, a rocket, and a hot air balloon could make and where they would be categorized. The children were not in agreement so they were discussing where they could go to settle the argument. When the lesson began they were on their way to the two large containers of books under the table, then remarked to each other that they would look when they got to put them out in their library later that day. They had referred to these books as part of the "space research center". The researcher assumed that there had been discussion concerning the establishment of the center previously.

**Visual Aids:** The same models were noted on top of the bookcase. The demonstration model of the space shuttle orbiter was no longer displayed.

**Storage Cabinets and Bookcases:** The Civil Air Patrol's box of curriculum, "THE FALCON FORCE", was on top of the storage cabinet near the door.

**Classroom Observation:** The time period that the researcher was in the classroom was used for spelling instruction with specific connector words. The necessary connector words were listed on the chalkboard. The lesson was verbal and the children were taking turns using the connector words in sentence that they made up. One student response indicated that aerospace
might have been discussed:

Child response: This example was given during use of because:"The vibration was felt because the rocket was launched."

Norma: Ok, ok that was very good using all those ideas.

There was no specific instruction relating to aerospace education.

Post-Observation Conference: There were no specific questions initially addressed to the subject. Earlier in the day Norma had walked through a room in which the researcher was holding a post-observation conference with another subject. At this point in time the researcher informed the subjects of the true nature of the research.

Conference Transcript:

Researcher: I don't know how much you overheard when I was talking to Paula.

Norma: Not much really.

Researcher: As far as this morning's observation goes, I don't have anything specific to ask you about what happened in the lesson. But back to what I was talking about with Paula. Because of the nature of my research approach I didn't want to tell you exactly what I wanted, because I didn't want you to feed me what you thought I wanted to see and hear. My main question has been about the outcomes of someone who has been a participant in an aerospace education workshop.

Norma: Gosh! I never even guessed. You were so interested in what happened in science. Boy!

Researcher: My question has been whether in fact after having taken a workshop like this one, and as I understand it this one was not
particularly set up for elementary teachers.

Norma: You're right, it wasn't.

Researcher: Again, whether an elementary person can get enough from the workshop to really use it in the classroom. My Master's Degree is in aerospace education from Middle Tennessee.

Norma: Oh, gosh, how exciting. I can't believe this.

Researcher: There have been some things that I've had knowledge of that you've provided information and input on without my having had to ask you directly. I've seen things with your bulletin boards and listened to conversations with your students that have also told me outcomes on your participation with the workshop. There are some things now that I'd like to ask you directly about how you use the aerospace principles in the classroom.

Norma: How neat! Just ask away.

Researcher: How do you use the airplanes and the rockets that are up there on the cabinet?

Norma: Well, we do a unit under force and motion on aerospace itself and so at this point they are used for discovery. Basically, just self-discovery for the children to go over and look at, explore, and compare with what they've had with home experiences and that kind of thing. No formal presentations at this point, but when we do our force and motion unit then we'll use those. We go all the way from paper airplanes to some kind of other models that they can put together. We talk about the forces, and how airplanes fly, and through rocketry, so they're introduced that way, too. We teach the parts of the plane.
Researcher: Thanks. Getting back to the workshop specifically. How did you hear about it, initially?

Norma: If I recall, I think we got a flyer of some sort, inviting us to take part in it. But I don't have a very good memory, so I'm sure what Paula told you about that must be right.

Researcher: Now, I remember from the first interview, you said your husband had worked for NASA, but was this workshop really the first introduction you had to aerospace education? Formally?

Norma: Yes, in a formal manner.

Researcher: Had you ever used any of it in the classroom before that workshop?

Norma: Yes, because the second year I taught I was teaching in [nearby city] schools. It was a real part of the program. Really my interest goes back that far.

Researcher: Then what would you say, for yourself, was the biggest change that the workshop brought about in either your teaching behaviors or your beliefs or whatever?

Norma: For me, the information that we learned was very valuable, because I had had just a lot of experience around people in the space program and just a personal interest with reading the newspaper. But the real meat of the course was very exciting to me because it was really a challenge. That made me more aware of real terms and affects that I had not gained just through my own interest. Being able to connect it with the weather unit and the force and movement really got me to tie all those things in. Then the materials they gave us were just
endless. We had just materials and materials and materials. Like you said they were not necessarily all elementary level, but you certainly can adapt them. That really helped because like the CAP materials would have just a unit on force and motion and you could just pull that out and get it to their level.

Researcher: I noticed one time as I left you had the Falcon Force box out. Do you use that material?

Norma: Yes, I do.

Researcher: Quite a bit?

Norma: Not quite a bit. I don't use it a lot, but I draw from it partly because of my own personal background and also they have some of the units are readily usable for second grade. Like the unit where they draw airplanes from different views. Some of the children love it. They just love it. And then some of the others, we have children who can read on that level so you can give them individual projects and research.

Researcher: Did they do much specifically on integrating aerospace into other areas of the curriculum, besides science and math?

Norma: Not in that class. Not in the initial one.

Researcher: That's just something you've done on your own?

Norma: Right, or Paula and I together. Because after that first year we really did work a lot together.

Researcher: How did you get involved in the Young Astronauts?

Norma: Through that course. Dr. Searby had the first mailings from Young Astronauts. He showed some of those during classtime. I sent
off for them immediately.

Researcher: So you would say that that really is a direct outcome of the workshop?

Norma: Oh definitely.

Researcher: How about the Space Foundation things?

Norma: I think our names got on a list somehow. Probably from the workshop. I'm not sure.

Researcher: You didn't have any Space Foundation information during the class?

Norma: No, no, not that I recall. They did give us some addresses and places for some materials. Some are good and some aren't. Like some have been passed on so many times like a recipe. They don't exist anymore. The materials they actually had for us, to put in our hands, were very worthwhile.

Researcher: Have you been to any of the Congresses?

Norma: Right, we went to one in Florida. I think that was the very next year after the class. That was just really exciting, really exciting.

Researcher: Have you had the opportunity to go to any of the other ones?

Norma: I mentioned this one coming up to my husband, because it's in a place that he'd like to be.

Researcher: Yes, Reno. I know.

Norma: So, maybe it will fall at the right time. Do you know when it is?

Researcher: Paula and I were talking about it and I think it comes right at the end of spring break.
Norma: Oh no.

Researcher: I know, that's what's prevented me. You think that you have time with the family and then . . .

Norma: Yes, well, we only have one, so she can go. [reference is to her daughter] She went to the Young Astronauts conference when we went to Oklahoma last year. The first international conference. That was really a treat. Really exciting.

Researcher: How have you felt about the support from the administration? Any lack or anything you feel is significant?

Norma: I feel they are supportive. They give me a lot of support actually. I think that it's definitely an area that ties into our specific program. I feel that anything that we initiate that is well researched and well understood we will get support for it. We certainly have for the Young Astronaut materials. We haven't gotten them as readily as we should have from Washington, but the immediate people here supported that and the parents support group pays for half of the fees this year.

Researcher: So even on the parent's part you feel a great deal of support?

Norma: Oh yes, right.

Researcher: Do you go, not out of your way, but do you specifically put a great deal of emphasis on explanations, especially for parents, so they know what's going on with this program?

Norma: Yes, at the very beginning of the year when we have our parent's group meeting I always bring that up as a special interest of
my own. How we are trying to extend it throughout the program and make it a real building process because our fifth graders go to Houston. One of the main places they visit is the space center. Over time we really need to make this a continuing effort for each grade so that the children are really building up to that big trip. So we're trying that so we can make parents more aware of that emphasis, and also the teachers.

Researcher: Do they seem very receptive?
Norma: Definitely, I think so. I think there is an element who don't even buy into the space program. I really think that's true. But I've never had any open opposition to the children working or studying or being active in Young Astronauts or anything like that.

January 10

Final Conference Transcript: The final conference began with extraneous conversation, which was omitted.

Researcher: How many hours would you say you have in science?
Norma: I probably have 21 hours of undergraduate science and graduate science probably about the same, 21 hours.

Researcher: Who do you feel you got the majority of the materials from that you used in aerospace.
Norma: Like the Space Foundation in Colorado? As far as variety, a lot of it came from there.

Researcher: How about cost?
Norma: No, they're cost free except for sometimes posters or t-shirts.
Something like that. They supposedly stock FAA, CAP and NASA material. Because those are all automatically free.

Researcher: Oh, sort of like a clearing house situation.

Norma: Right. But as far as having good availability they're not always available.

Researcher: Let's focus specifically about the workshop. Is there anything that you can think of that you would either add or change in some way to have made it a more valuable experience?

Norma: I would like to have had more hands on with flying experience. When I took my kids this past summer to Meacham, I only had half a dozen from [nearby district school]. I happened on someone who was an instructor in a flight school. He put everyone of those kids in the seat of a plane, explained about the instruments, and that sort of thing. He did it in like two or three planes, so they really got a feel for what it felt like and looked like and that sort of thing. I really feel that that would have been a valuable experience to have that happen. Also I hope I'm remembering right, we had a deacon at our church who was an instructor at Simuflite. He also took our kids there, took them through a simulator, and turned on the movement part of it, and that sort of thing which is really exciting. I don't think we did anything like that when I was in the class.

Researcher: Have you had any other business contacts aside from the regular materials from the FAA and the CAP?

Norma: Well, we have parents in this program who work at like General Dynamics. I don't know if we've had any from Bell, but GD has given us
glossy photos for the kids. They've given us some VCR tapes to run. They always have someone who will come speak. One of them brought that huge plane that they have setting by one of their office buildings. I think one thing is that we just haven't had any contact with them specifically. And like I said just like knowing that person that I was talking about [instructor at Simuflite] just getting to go there. Now I'm talking about summer, not just about the school year. But I think that they would be willing at least to have the kids look through their facilities. I think as far as things or materials that are hands on kinds of things I can't think of anything else.

Researcher: Have you talked to anyone who has taken the workshop subsequently, about the practicum?

Norma: I guess I haven't talked to anyone. Let's see, I know we went on one of the class trips another summer. We went to Washington. We didn't have that much conversation. However, for my own self I think that's the only way that I learned what I was going to do. It's just essential. It may have been a real headache, grueling, not much fun. But the fact that contacts that were made. Actually taking the kids on a field trip. That actual seeing it with children gave me the confidence to actually do it by myself that next year. So definitely, the practicum was extremely valuable.

Researcher: Have you had any specific follow-up from anybody from the workshop?

Norma: No.

Researcher: Is there anything else that you want to add?
Norma: I found that being in this program is really an asset. Being in the math and science sort of program, what we do with aerospace really fits in beautifully. I would like to see it even more emphasized in the program because the interest is there already. The children have it about flying and everything from the beginnings on. Paula and I have talked in the past about really fitting it into more areas of the curriculum because we do timelines. We do so many things in reading and you could just pick it up and do it in reading if you wanted to. And in different years we've emphasized different things with different groups. You find that you really have to vary things with the children.

Researcher: Have the two of you thought of writing any curriculum?

Norma: We had talked about it just kind of in general because of that course in Colorado. We had to write a piece of something for class. The summer programs, most of the information has just been kept in our heads. But we have just kind of thought it would be neat to just kind of write it up. Especially since we've done it one year for the district and we've seen what you can do in the public school, as well as the private, and have a pretty good success.

Researcher: Have you ever been approached by any of the administration about coding any of the aerospace curriculum with the essential elements?

Norma: No, no I haven't.

[Taped transcript stopped at this time. However, as the researcher was about to leave, the librarian brought in a set of books that Norma had]
ordered for use in her classroom. They were a set of readers, written on a particularly simple level, suitable for second grade usage. The content dealt with aerospace and aviation. The researcher spent time with Norma looking through the vocabulary lists and the information contained in each book. Norma had ordered four of each title so they would be easier to use for group reading instruction. She intended to put them into use as a supplement for the group reader already in use.

Lesson Plans

Norma's lesson planbook contained thirty-three specific references to aerospace, within a sixteen-week period examined by the researcher. These specific references occurred in eight separate subject divisions. The activities included worksheets; from the adopted science text, supplementary activity books, and teacher made materials, experiments; from the adopted science text and a supplementary manual, model-making projects, puzzles, oral-reports, and specific activities from Young Astronaut material.

WEEK  SUBJECT AND TOPIC

1  Science: Air takes up space unit.  Art: Science report in picture form.
2  Science: Air has pressure. Make a cloud in a jar and study cloud chart.  Art: Science report in picture form. Draw cloud chart.
4  Reading: Book: "Cloudy With a Chance of Meatballs"  Science: Weather worksheets and charts.  Art: Young Astronaut work.
WEEK  SUBJECT AND TOPIC
5  Reading, Language, Writing, Handwriting: Storywriting on previous week's reading. Science: Make weather terms relate to "real" setting.
6  Reading, Language, Writing, Handwriting: Continue writing and editing detailed story from the previous week.
7  No specific references to aerospace noted.
8  Science: Young Astronauts
9  Math: Thermometers. Science: Balloon experiment, then balloon launch.
10 No specific references to aerospace noted.
11 Science: Discuss birds and flight.
12 Reading: All week write and discuss "Non-Fiction Science Area." Reports on birds are assigned. Spelling: Bonus words included "space."
13 Language Arts, Science: Young Astronauts
14 No specific references to aerospace noted.
15 No specific references to aerospace noted.
16 No specific reference to aerospace noted.

Paula

Paula is in her late fifties. She is a very athletic individual and teaches swimming classes to adults and children during the summer. She is one of three second grade teachers in the same specialized math and science program as Norma. This is her fifth year of teaching in this particular setting. Paula teaches across the hall from Norma.
October 19

Phone Conversation: The researcher introduced herself and let Paula know she was going to be doing observations in science, and possibly in some other classes, to look for activities related to science. The researcher asked Paula if she would consider participating in the study. Paula responded in the affirmative. The researcher asked her to check her schedule to see if there was a time when they could spend 45 minutes to an hour for an interview. The researcher would call back to confirm a time.

October 26

Phone Conversation: The conversation related to setting a time that would be appropriate for conducting the first, formal interview. Paula had nothing significant going on in her schedule. Therefore, a meeting was scheduled for November 1, after school.

November 1

Classroom Set-up: There were five tables with 4 chairs at each.

Bulletin Boards and Wall Displays (Teacher Made): The researcher had a limited view of the classroom. At the entrance to the classroom there was a birthday poster. The poster depicted an airplane flying through twelve clouds. The names of the children were written on each cloud.

Bulletin Boards and Wall Displays (Student Made): None were observable to the researcher.

Learning Centers: None were observable to the researcher.

Visual Aids: None were observable to the researcher.
Storage Cabinets and Bookcases: There were several storage cabinets in the classroom, however the contents was not observable to the researcher. There was a bookcase behind the teacher's desk, but there appeared to be nothing related to aerospace in the contents.

Classroom Observation: This meeting was held after school hours, therefore no children were present in the classroom.

Conference Transcript: Initial Interview.
Researcher: Tell me a little bit about your program. Is there anything specific of which I ought to be aware?
Paula: We do some planning together, in things like field trips and long range goals, but most of the curriculum is handled in each class. This is a magnet program for able learners. The science periods are sometimes planned long range. We tend to do the units at the same time. Like we begin with weather and now we are working on animals, but I'm free to approach it so I'm comfortable with the subject matter. Now, we also work all year, sort of on-going, with aerospace with the children.
Researcher: Really? How so?
Paula: For instance, now we're making hot air balloons. We'll use a hairdrayer to launch those when we get ready. That's sort of on-going that I just sort of fit it in with the other curriculum through the year.
Researcher: Ok, not just during the science period?
Paula: Right, not just science or during only one unit. Now, we did just finish our weather unit, so this is sort of an overlap with that, but we will go on in and do some history of aviation. Part of that would hit social studies, and part of it is with science, so it just sort of fits in
wherever.

Researcher: Give me a little bit of background with your education.

Paula: I have two Bachelor degrees from [Area University D], a B.A. and a B.S. Kindergarten and primary education is my major and I did some graduate work at [Area University B]. Following that then, in 1979, I started back as a full time, not full time, part-time graduate student at [Area University B] and completed my Master's in 1982, up there, in reading. Since then I have taken summer courses, and courses during the school year, from [Area University D], [Area University A], and [Area University C], most of which are either science or gifted education. We took an aerospace science course at [Area University C] and I took a gifted education course from [Area University D] and then teaching science for the gifted at [Area University A].

Researcher: How about your teaching experiences?

Paula: I taught one year following my college graduation in [specific city], Texas, which is in the [nearby] District. I had first and second grade combined in a very small country school situation. Following that I moved to [Present City] and taught two months at this school, [school name] in 1953. I quit because of pregnancy and took a 20 year maternity leave! I came back into teaching, in 1973, in the Follow Through Program, which was a federally funded program for children who were economically deprived. It was an extension of the Headstart Program.

Researcher: What age levels have you taught?

Paula: Ok, I taught one year at fourth grade and nine years of second
grade in that program. As long as the program continued. Then that program was phased out. When this magnet program was started I applied and was one of the original teachers. I’ve finished five years and this is the sixth year of the program.

Researcher: Ok, have you taught, either formally or informally, any grade level above fourth grade?
Paula: No. Other than teaching swimming to all ages, including adults I have trained as instructors for the water safety programs and taught advanced life saving and water safety.

Researcher: Ok, so basically intermediate to lower elementary levels?
Paula: Yes, and I taught also three years of preschool at our church.

Researcher: If you were given a choice of any subject area to teach, what would you choose?
Paula: It would be very hard, because I like all the areas. Probably, if I had to teach just one, it would be science.

Researcher: Any certain reason?
Paula: Because I like it and I like all the versatility with all the different things you can do with science.

A parent came in for an unscheduled conference at this time. The subject asked if the parent could come at another time, but that was not possible. A direct classroom observation was scheduled for the following week, with a conference immediately after the lesson.

**November 7**

**Classroom Set-up:** There were five tables with four children sitting at
each. Each grouping was coded by use of the names of the shuttle orbiters: Enterprise, Challenger, Atlantis, Discovery, and Columbia. An orbiter cut-out hung above each table, like a mobile, with the children's names suspended under it. A picture of the group, sitting at their table, hung under this.

**Bulletin Boards and Wall Displays (Teacher Made):** No new displays were noted as different from previous visit.

**Bulletin Boards and Wall Displays (Student Made):** One side of the room consisted of a display of charts from the weather unit. Each child had drawn a specific chart illustrating the flows for wind currents and rainfall patterns.

**Learning Centers:** The writing center was set up with a border which included clouds, rainbows and airplanes.

**Visual Aids:** There was a set-up on the table at the front of the room. The table contained dioramas, made by the children, illustrating different aspects of a city. As the researcher entered the room, a child came and explained that they had gotten to work in groups and come up with what they thought they would need for the "area" to work. One group developed a farm, one an area by the water, another a downtown district and another a residential area. The residential area included an airport and a runway set-up.

**Storage Cabinets and Bookcases:** No changes were noted.

**Classroom Observation:** The lesson was set during the regularly scheduled science period. The children were engaged in conversation concerning the ability of fish to swim. There was no specific reference to aerospace education during the lesson, however the teacher consistently referred to the children by terminology related to shuttle crew duties.
Post-Observation Conference: The conference began while a child was still in the room working on a make-up reading assignment. Extraneous conversation, relating to the child's behavior, was omitted.

Conference Transcript:

Researcher: Tell me a little bit about the folders that they use.

Paula: Ok. For each Science unit we have a folder. It's notebook paper for taking notes and writing up experiments. Then there are also some worksheets. Printed worksheets that they have to work through.

Researcher: Are the worksheets specifically from the curriculum, what you decide, or possibly a mixture of both?

Paula: It included ones from the Holt Science, the basic ones. Then I add other worksheets from other sources.

Researcher: Do they take the folder home when the unit is complete?

Paula: Yes, they take it home, and they can keep it. Then we start a new folder for each unit.

Researcher: Do you have any of the folders available from any of the units that you've done before?

Paula: I think they all took them home from the last one, but you'd be welcome to look through these. [Teacher shows the researcher folders for the animal unit that they are involved in now]

Researcher: The process that was on the board, is that something that you follow for most of the work?

Paula: Yes, it's one we follow, but you can tell that some of the still don't really know what an observation is.

Researcher: Tell me a little bit about your management process, with
the tables and the shuttles.

Paula: Each table is basically a shuttle crew: the Flight Chief, a Mission Specialist who takes care of passing out materials, a Maintenance Manager is responsible to see that things are cleaned up and a Data Specialist who does any reporting or recording. And that's the way we set them up. It's similar to the science group plan except we just gave them more "spacey" names!

Researcher: Where is it that you got your materials? Your shuttles look like cut-outs?

Paula: My husband drew the space shuttle. He was going to ink in all of them. Then I decided, hey wait a minute, let's do one and then make copies. What we did was I ran them off on the copy machine and glued them on both sides of poster board, and then laminated them. It was really quite a process.

Researcher: Do the kids rotate in the groups?

Paula: They've been in the same groups since school started, but I plan to do some changing at the end of the next 6 weeks. We have some little personalities... Several of the children have trouble working during unstructured times. They seem to be more immature this year. Like with the hot air balloons we're building this year.

Researcher: How so?

Paula: Well we also do a lot of things using the Young Astronaut program. The hot air balloons have been an extension from the weather unit we just finished. These children have used a lot of glue on the tissue paper and honestly I'm not sure some of them aren't too heavy to
fly! I have done this same activity with the Space Camp groups in the summer time and I think the older the child the more concern with making the balloon. Some of the older ones almost get too concerned with making it neat.

November 17

Conference for Examination of Materials: During this time there was no recorded conversation with the teacher or direct observation of classroom activities. This meeting was for the purpose of examining the subject's lesson planbooks and to detail the contents of the science textbook.

Bulletin Boards and Wall Displays (Teacher Made): No new bulletin boards were visible to the researcher.

Bulletin Boards and Wall Displays (Student Made): The student weather charts were down from the wall. No new displays were noted.

Learning Centers: None relating to aerospace were noted.

Visual Aids: The group projects, sitting on the table by the entrance, were finished and were being displayed.

Storage Cabinets and Bookcases: No changes were noted.

November 28

Scheduling Conference: The researcher made direct contact to stop check on December scheduling. The teacher was gone with the class on a field trip, but left a message to check again after the Thanksgiving holiday.

Classroom Observation: No changes had occurred in the classroom setting, or displays, since the researcher's last contact.
December 7

Scheduling Conference: The researcher made contact to review lesson plans and schedule another observation period. It was decided because of testing and the coming holiday season that observations would be discontinued until after the Christmas holidays.

Bulletin Boards and Wall Displays (Teacher Made): No changes were noted.

Bulletin Boards and Wall Displays (Student Made): A new bulletin board was up in the hallway. It was a bulletin board on transportation. The children had drawn pictures of various means of transportation and had written a narrative explaining their choice. The pictures consisted of a horse-drawn carriage, an auto, a tank, a train, a horse, a bike, a sailboat, an airplane, a rocket, a hang glider, a space shuttle, a blimp, an aircraft carrier, a helicopter, and a hot air balloon.

Learning Centers: None were observed at this time.

Visual Aids: None were observed at this time.

Storage Cabinets and Bookcases: No changes were noted.

January 2

Scheduling Conference: This was the first class day in session after the Christmas holiday period. The researcher stopped to make contact with the teacher during the regularly scheduled breaktime. After having examined the lesson planbook, the researcher noted nothing specific to aerospace education. It was decided to observe during the language arts period. The researcher and the subject agreed that the observation would occur during
the morning, sometime that week. No specific time was set.

January 4

**Classroom Set-up:** No new additions to the room had been made since the last observation. The children had been moved around from the groupings noted before Christmas vacation.

**Bulletin Boards and Wall Displays (Teacher Made):** No changes were noted.

**Bulletin Boards and Wall Displays (Student Made):** The same transportation board was in the hallway. No new additions were noted.

**Learning Centers:** No changes were noted.

**Visual Aids:** No changes were noted.

**Storage Cabinets and Bookcases:** No changes were noted.

**Classroom Observation:** The class conducted lunch count utilizing the terminology for job descriptions for the shuttle crew members. The lesson began with instruction for spelling. There were no specific references to aerospace during the time period.

**Post-Observation Conference:** The conference occurred after school the same day that the observation had been conducted. At this point in time the researcher informed the teacher of the true nature of the research.

**Conference Transcript:**

Researcher: I really have no specific questions about my observation today. Some of my observations have been concerned with specific science outcomes, but basically I've been concerned with the outcomes of your having been a participant in the summer aerospace workshop.
The reason I didn't tell you before was because of the nature of this type of research. I didn't want you to feed me something that you felt I specifically wanted to see.

Paula: Oh Really! Tell me about the process. [At this point the guidelines for the specific research process were discussed with the subject.]

Researcher: Did you have any interest in aerospace before you took the workshop?

Paula: To an extent. I've always been interested in science. I've always been really interested in space and studying the planets. Way back, even when I was a little girl, when I was interested in astronomy. I used to sleep outside with a flashlight and a National Geographic, when it was safe to sleep out in your backyard. But really, when I signed up for this course I had no idea what it was about. It just said something about aerospace education and it sounded interesting but I had no idea.

Researcher: How did you hear about the course?

Paula: We got a flyer sent to the school through the gifted education office I think. I'm not sure anymore. But anyway, we got the information and we were asked if we were interested in taking the course. Scholarships were available, so, I signed up on that basis. Now the first year was the only year I think that [Area University C] did the practicum. We had six hours. We had the course for two weeks and then we did a space camp.

Researcher: Oh, Ok.
Paula: We did it on campus. Now, they have discontinued that as far as I know, but I think that was a wonderful thing.

Researcher: Do you have any idea why they discontinued that?

Paula: I don't know. Just the following year they didn't have it. Mr. Johnson, over at [nearby school district], learned that [Area University C] was not doing one. He asked Norma. She started the Young Astronaut program at [same nearby school district]. She was interested and wanted to get the program going because of her daughter. But anyway she went over and did the camp that next summer for [same nearby district]. I was involved in other things that summer. I went out and did a session with them in the water. We did weightlessness in the water, so that was my contribution that year. Then the following year he asked if we would repeat the camp. We had larger numbers so he had an opening for teachers for the camp. This past summer the gifted department talked to us about doing it for the public schools. Two weeks for summer enrichment. So we did that program over at [another school within their district].

Researcher: What was it particularly about the workshop that you think fueled the fire, so to speak, even though you had the interest? What was it about the workshop?

Paula: I think it was the idea of teaching something new and different and that would be exciting to the children. And that practically every subject can be related to aerospace. Everything can: music, art, P.E. Everything you do you can related to aerospace. And this is the field of the future for our children. When they grow up there will be lots of job
opportunities related to the space program. It's just something that I think they should be stimulated by now and be interested in.

Researcher: Do you feel that you had to do a lot of grubbing for materials, or is that something the workshop helped you with?

Paula: The workshop provided us with an abundance of good materials. The following up with other information helped. See, Norma and I also went to Colorado Springs for two weeks with the Space Foundation. They had a workshop in conjunction with the Air Force Academy. So the summer before last we spent two weeks up there.

Researcher: How did you find out about that one?

Paula: Again we got a flyer sent to us. We picked it up and said, hey, we thought that we could like to do that. We talked to the gifted office again and we didn't get all of our expenses but they did help a lot. They paid our tuition for the workshop and we were on our own as far as transportation and meals. We also have attended one Space Conference, The Aerospace Teachers Conference down in Orlando, Florida.

Researcher: Ok. Was that the National Congress?

Paula: Yes, and again we had airlift down there. The airlift is a big incentive to do some of these things. You know, free airlift. Unfortunately, the last two conferences have come just at the end of spring breaktime when I already have plans with my family. I wish they had it at a different time.

Researcher: I understand. It's been a few years since I've been and for the same reasons.

Paula: Well, they did one, one year it was not at the same time. You
know prior obligations. At this point I do not want to choose between the two, so I guess I'll have to wait. About materials, I have boxes and boxes that I haven't even touched. I've used them, but I get so busy. I have enough materials that I probably could teach nothing but aerospace all year.

Researcher: What sorts of places have you gotten the materials from?
Paula: The CAP, FAA, NASA, and of course I'm still on the mailing list for NASA, so they send me up-dated packets periodically. Of course, the Young Astronaut membership.

Researcher: Has the majority been at relatively little expense for you?
Paula: Yes, it's free. All of it has been free. Except for a few things that I elected to purchase from the Space Foundation, such as a trivial pursuit type game where they have to try to spell the word SPACE by getting five cards from each category. I purchased that because I wanted to have it in my classroom, but most of the materials are free. Then, some of the different aviation companies put out some things too.

Researcher: Do you think the mailing list thing kind of feeds it?
Paula: Oh yes. And then from the Space Foundation I have twelve hours of video tapes. All I did was buy the tapes and choose, they had along list of films that they had from various sources like from NASA, CAP, FAA, from all these various sources. I went through and wrote down the things that I wanted and sent them the blank tapes. They put all the material on it and sent it to me.

Researcher: How wonderful.
Paula: Now one other thing that we're excited about, next week we will
have a computer installed and we will be on-line. The Space Foundation has a network and we're hoping to get in on that. One of the things that they have is when we went up there we all did lesson plans. They're on the network and as they have these workshops they add more lesson plans. That's one of the things that we can get but we can also get like up-dates to the space shuttle missions and all the current information and things like that.

Researcher: Have you felt support from administration on doing the aviation education?

Paula: I have not felt any lack of support, I'll put it that way. I feel that certainly Mrs. Anderson has been very supportive of it. As far as other administrators, I think they're aware that we're doing it but I haven't heard any feedback one way or the other. I had to convince Dr. Smith, back when we were getting ready when we were asking for funding for the Colorado workshop. I happened to be in her office, working on second grade curriculum materials, and I handed her that flyer and I said, I'm real interested in taking this, and I wondered if we could get some funding for it. She looked at that and said, what use is that for elementary teachers. Well, since I'd had that first workshop, I was ready! I told her all the different ways it could be related, even without leaving out any of the things that are required. For instance, in science we have a unit on air and weather. It fits right in there. We do hot air balloons. We do some of the other things related to it. We have another unit on force and movement and we do simple machines and the forces and I go right on into flight. How an airplane flies. I mean
during the air unit I do Bernoulli's Principle. There are so many things that just tie right in even if I didn't do a unit on air and space, which I do. I kind of tie in to my science and after we do force and movement I go right into a unit on air and space by itself. I do these things all year. Like reading today, one of my groups had a story. It was an article about space. We had already done earlier this year a little packet from Young Astronauts on the space shuttle so they had a lot of background. Some of the illustrations were right from the film I had shown them with Sally Ride and the other astronauts. We had shown this whole thing on eating and sleeping in space, which they loved. It gave them a real idea of what weightlessness means.

Researcher: Did they relate that article back to what they had seen?
Paula: Yes. I said, do you think you've seen this picture before? One of them said, "oh yes, that's Sally Field. [child could not remember Sally Ride] That's that movie you showed us," and "some of the pictures look like that" and I said yes. They were taken right from the movie. They're relating things all the time.

[At this point another teacher came in to use the conference room. A time for a continuation of the conference was set for the following week.]

January 11

Final Conference Transcript:
Researcher: If you had a specific recommendation for the workshop, what would it be?
Paula: Well, I think reinstate the practicum because to me anything
that you learn and you teach you'll retain more. If it could be organized and have some time to plan. I think they gave us one two-hour period during the two weeks of class to plan. It needs some kind of a format to use it. I really think, because we had the practicum, we could see what works and what doesn't. It gave us a trial and error, like when the fifth grade section was going to use Exacto knives for the rockets, and we at the lower level decided no way would the second and third graders be given an Exacto knife on their own. That would be my main recommendation. That they try to reinstate it.

Researcher: Have you had any input in subsequent years from anyone else who's taken the workshop?

Paula: No, I really don't know anyone else who has. I don't know if they're promoting it as elementary. I do know that the district is not picking up tuition. I know I would not have enrolled that year if the tuition would not have been provided. I'm not in the financial position to do that. And even if I had been, not knowing what it was about, well, you know that's tough.

Researcher: Have you used anyone else, other than who we've talked about, to get materials from?

Paula: Maybe some donations from the area companies. Maybe Cessna or Beech.

Researcher: What about the Ninety-Nines?

Paula: I know who they are, but I didn't know they did anything with education, or had materials.

Researcher: What would you say was the main outcome from the
workshop?
Paula: Content and materials. We were given a lot of suggestions for correlating it with the essential elements and for ideas of how we could work it into curriculum, even if we did not do a whole unit on it. Maybe just bits and pieces of it for incidental mention.
Researcher: Have you had any follow up from anyone in the workshop?
Paula: No, not specifically.
Researcher: Is there anything else that you'd like to add for the completion of this study?
Paula: I think we need more teachers trained in aerospace. I think it needs to be written into the curriculum.
Researcher: How would you feel about an elementary certification?
Paula: It's not necessary as long as it's in the curriculum and covered by the essential elements. If it's not written into the curriculum it's not going to be taught. There are so many, "if it isn't in the manual you can't do it." If it were down on paper telling about all the different ways to relate the subject, I think it would be used by more people.

Lesson Plans
Paula's planbook contained thirty-six separate references to aerospace, within a sixteen-week period examined by the researcher. The specific references occurred in five separate subject areas. The activities included story writing and poem writing, current events, timelines, report writing and activities from Young Astronaut materials. The planbook did not give the names of supplementary materials, other than references to the Young
Astronaut packets.

WEEK | SUBJECT AND TOPIC
--- | ---
1 | **Science**: Weather unit. Talk about hot air balloons.
2 | **Science**: Young Astronauts: Space Shuttle Packet
3 | No specific reference to aerospace noted.
4 | **Language**: Write a story or poem about weather. Suggested titles include: Taking a Trip in a Hot Air Balloon.
5 | **Science/Art**: Make hot air balloons.
6 | **Science/Art**: Continue with hot air balloons.
7 | No specific reference to aerospace noted.
8 | No specific reference to aerospace noted.
9 | **Social Studies**: Current events: watch shuttle launch on T.V. Write about earth quake or shuttle launch. **Science/Art**: hot air balloons.
10 | No specific reference to aerospace noted.
11 | **Reading**: Story reading: "Cloudy With a Chance of Meatballs."
12 | **Reading**: Story reading: same as previous week. **Social Studies**: Young Astronaut Activities. **Science**: Young Astronaut Packets.
13 | **Reading**: Story reading: same as previous week. **Language**: Creative Writing: "Weather Reports." **Social Studies**: Define transportation with specified categories: Land, Sea, Air. Reports on transportation. Transportation on a timeline on flight. **Science/Art**: Finish hot air balloons and launch.
14 | **Social Studies**: Transportation timeline continued.
15 | No specific reference to aerospace noted.
16 | No specific reference to aerospace noted.
Paula and Norma's Principal

The principal had been informed, by the district research director, concerning the researcher's purpose for observing teachers within her building. The principal had informed the researcher that it might be more advantageous for the study, if the interview were to be with the science and math coordinator for the program in her building. The rationale behind the suggestion was that the principal felt the coordinator dealt with specific science questions, where she dealt with the larger, broad concerns of the teachers and took care of the interaction of the curriculum with the children. The researcher assured the principal that it would still be germane to finish conducting the scheduled interview. However, the researcher added appreciation for the suggestion, and allowed the principal to call and set up an interview with the coordinator.

Interview Transcript:

Researcher: Have you noticed anything particularly noteworthy about the science instruction in the second grade with Norma and Paula?

Mrs. Holtz: As far as particulars, I really don't deal with what goes on with specific instruction for that program, although I must approve everything that is taught and make sure that the specific elements are being attended to. Both of those teachers are extremely hands-on individuals, when it comes to their approaches in teaching science.

Researcher: Specifically, I am looking at their science instruction to see if there are any concrete outcomes from their having been enrolled in an aerospace education workshop one summer. Were you aware that they had attended this workshop?
Mrs. Holtz: Yes, I have to approve everything they do.

Researcher: What are you feelings about the use of their aerospace and the aviation education projects in their classrooms?

Mrs. Holtz: I think it is an extension to what we're doing and I can see no harm in it. I think it's an enrichment for the children.

Researcher: Do you see them using it beyond the science area?

Mrs. Holtz: If they can correlate it with other areas, yes. If they can effectively correlate it with some of the other areas. In fact we are stressing that all of our subjects be kind of aligned with other subjects where they can be correlated and we can teach in a more holistic kind of way rather than an isolated subject area. If we're teaching science certainly we can bring in some math. We certainly can bring in reading, vocabulary, all that is included.

Researcher: Rather, an integrated curriculum?

Mrs. Holtz: Right. An integrated curriculum.

Researcher: Have you seen any instances where you've detected any problems as far as accepting the aerospace education in the classroom?

Mrs. Holtz: No, I really haven't. Now, I don't know how wide-spread this might be throughout the district. I think perhaps it might be unique to our particular situation. My rationale for allowing teachers to carry it on is because we are a math and science kind of program. And I feel that, if it is to be implemented, this is the program where it ought to take place.

Researcher: How would you feel if there were another teacher in the building who decided to go through the same workshop session and
brought it into her classroom? Would there be any specific things that you might require, as the principal, in order to feel more comfortable with that outside the magnet program?

Mrs. Holtz: It would be fine so long as it were implemented so it doesn't, let's say, go too far or beyond the basic sequence of what we have in our curriculum. We certainly would not want our curriculum to be deleted to make provisions for this. We would consider it to be an extension to the regular program.

Researcher: Are there anythings that have to be checked as far as essential elements go with lesson planning?

Mrs. Holtz: Yes. This is what I meant when I said that our essential elements, the state essential elements, are integrated into our curriculum. Therefore, it is not an isolated thing. It's already aligned. We don't have to align anything special for it. We would check to make sure that we are within the guidelines of the state. As I said, it would have to be an extension, an enrichment. It would not be in lieu of, or in place of, the essential elements that are in our curriculum.

Researcher: When I asked both of them how they had heard about the workshop, they mentioned that it was a flyer through the system. Do you remember when that came through? Did it go to everyone or did you just sent it to the magnet program?

Mrs. Holtz: No, usually those flyers are place on the bulletin board. Then the teachers, any teacher, has access to it. The teachers make a decision on a voluntary basis, if they are interested.

Researcher: If there is an interest area?
Mrs. Holtz: Yes, they were not selected by the district.

Researcher: Thanks. That answers my question there.

Mrs. Holtz: Yes, it's their decision. They were the ones who wanted to do it. Usually is they want to do these things I see no reason why I would not approve it simply because it is an extension to their educational background and their expertise. It is also an incentive to bring in these new ideas to the kids.

Researcher: Have you ever heard comments from the parents about the activities.

Mrs. Holtz: No, not about those activities. Which means they're satisfied. And when they're not satisfied I would have heard it, loudly and clearly! Believe me! Yes, as far as I know they are satisfied. But I haven't specifically asked them because I really don't want to arouse their curiosity. Usually I get my feedback based upon their concerns to me and there have been no concerns voiced.

**Norma and Paula's Science and Math Coordinator**

The interview had been set up for the researcher by the building principal. The coordinator was busy with another teacher when the researcher entered the office. The principal had informed the researcher that specific background information, concerning the study, had already been given to the coordinator.

**Bulletin Boards and Wall Displays:** The outer office of the science and math coordinator was decorated with bulletin boards on each of the walls. One bulletin board contained pictures captioned, "Young Astronauts" and
showed snapshots of children and printed material from the organization. There were also several black and white snapshots of a visit to the school by a NASA Spacemobile. These pictures depicted the NASA Education Specialist involved in hands-on experiments with several of the children.

Interview Transcript:

Researcher: Is the curriculum that's used in the magnet setting the same curriculum that is used in the regular classroom?

Mrs. Anderson: Well, yes and no. In the magnet setting we take the curriculums that are used in the public schools and all of the other classrooms. Our teachers, through training and working with gifted and talented children, are charged to enrich that curriculum. . . . We are going to build a new science and computer center. . . . It will certainly give us hands-on, which is so important and what you want in education. . . .

Researcher: Both Norma and Paula seem to have been very involved with the Young Astronaut Program. Is this something that they brought into the curriculum themselves, or was it suggested to them?

Mrs. Anderson: This is my fourth year here. The coordinator that was here before was the coordinator for three programs, and had some additional programs in the regular schools. The teachers would meet with him periodically and suggest things, but he left me a folder of suggestions and that was not included in that folder. The first year I came, the beginning of the school year in 1986, they came to me. They were the only two second grade teachers at the time. They talked about that and wanted to take the workshop in Colorado. They wanted to do
those sorts of things with aerospace. Then, that year, we added our two
fifth grade classes. One of the things that the fifth grade teachers
wanted to do, to culminate the year, was to carry the students to NASA
as a part of being in the program. We worked, with the parent's help, to
raise money and so forth and so on. The children had three days and
two nights. We went through San Marcos to Houston, to do geological
studies on the Gulf, and so forth and so on. Making that trip to NASA, as
a culmination, made the teachers last year look at putting together some
goals and objectives for their grade levels. Then, we looked at the goals
and objectives for their grade levels, and I had them give me what they
felt should be the goals and objectives for the total program. The trip
was one goal that they felt we should include and the emphasis on
aerospace. And it just works out great with Norma and Paula's training.
You just couldn't ask for better teachers anyway, but to have them at
the second grade level to begin some of those things that they're doing
and move through the curriculum, adding a little each year, as much as
we can, so that by the time they get to fifth grade they actually get to
go to NASA. You know, you have this building, layer upon layer, like
the constructionist's viewpoint, starting at second grade and building by
the time you get to fifth grade. And I must admit, I'm always just so
proud of the boys and girls when we go. We attend the educational
programs, and a few years ago we had to go on a day with the middle
school, and one year I think we had to attend on a day scheduled for
high school, because of scheduling conflicts here. Well, there was not a
question that they asked that my students could not answer. They
would raise their hands and give the M.C. some idea that they knew. In fact, that year we were in the high school program, they kept saying “Where are these children from?” The teachers just build upon it and then in fifth grade they really emphasize it.

Researcher: How much do you have to do with, or how closely do you work with, the district science coordinator?

Mrs. Anderson: This year, in fact this fall, is her first year in the position. I had been working with Dr. Smith, but she retired, so I have not had much contact with her (the new coordinator.)

Researcher: Do you feel, administratively, that there’s been any lack of support for adding aerospace or aviation to the curriculum?

Mrs. Anderson: No, I don’t believe there has been. In fact, in a district this large, with the science coordinator, they’re as supportive as they can be here, in terms of the amount of time they have. I feel they would be there if we really had a question.

As the researcher left the office, the secretary reminded the coordinator of a specific topic of concern. The coordinator would like to try and find an old school bus. It seemed that Norma and Paula had spoken to her about trying to decorate a bus, like a space shuttle, so it could be used as a traveling science center for the program. They wanted to use the bus like NASA used their SpaceMobile, and conduct on-site programs to advertise the program curriculum. Mrs. Anderson related that they already knew where they could get metal work done for the bus. The administration was supportive, but they had to refurbish the bus the teachers had found, and put it back into service.
School B

School B, where Mary taught, was a relatively new school built in an area which was a mixture of a rural and urban setting. The school had a student population of close to 600 children, but there was a great deal of movement in regard to enrollment. There were a number of apartment complexes in the area, in addition to an extremely mixed socio-economic area of single-family housing. According to information from the subject, there were a number of single-parent families and a large number of "latch-key" children. Because of the location of the school, even though it was considered to be a neighborhood school, there were still a number of children riding the bus. The school had a full-time principal and a vice-principal who also had duties as a classroom teacher.

Mary

Mary was in her early fifties. She was teaching in a self-contained fifth situation. This was her second year at Building B. Shortly before school began, Mary fell and broke her ankle. She'd had surgery and was in a wheelchair. By the end of the study, Mary was able to move around the room on crutches, but was still unable to move in the room as accustomed. During the first interview, the teacher informed the researcher that the room was in disarray because she could not reach any of the cupboards and her bulletin boards had been put on "stand-by" until she got out of the wheelchair. Therefore, for reporting purposes, the usual Bulletin Boards and Wall Displays were not designated as either "Teacher Made" or "Student Made", and were noted as "No changes were noted" in subsequent entries.
October 19

**Phone Conversation:** The researcher introduced herself and explained that the reason for the call was to ask about her future participation in a study which would entail classroom observations during the science period, with the possibility of observations during another subject area. It was also explained that there would be interviews involved. The subject agreed to participate, but also informed the researcher about her physical condition, resulting from a recent accident. The researcher asked the subject to check her schedule so an observation could be set up in the near future. The researcher told the teacher that there would be a call-back the next week to confirm an observation date.

October 28

**Phone Conversation:** The researcher spoke with the subject concerning setting an observation date for the following week. The teacher informed the researcher that she was going to be out of town, attending a science conference, and would not be available the following week. After checking her lesson planbook further, the subject agreed to November 10 as a date for the first observation, scheduled for the regular science period.

November 10

**Classroom Set-up:** The classroom was set up with sets of four desks grouped together. There were several desks moved out of the groups. At this observation the researcher could not see how many groups there might be normally.
**Bulletin Boards and Wall Displays:** Large cut-outs of the planets were set around the top part of the room on two walls. There were two pictures of military jets on the chalkboards, but neither carried any sort of narrative. There was a NASA poster, "View of Earth," on the side of one of the cabinets. It was a view of earth taken from space.

**Learning Centers:** None were noted at this time.

**Visual Aids:** None were noted at this time.

**Storage Cabinets and Bookcases:** There were several storage cabinets in the classroom. The space above the lockers, in the back of the room, was also used for storage. In the spaces the researcher could see, there were no materials related to aerospace noted.

**Classroom Observation:** The interview had been scheduled during the time period after school. No students were present in the classroom.

**Interview Transcript:**

Researcher: Tell me a little bit about your educational and professional background.

Mary: Ok. I took my undergraduate work at the [specific university outside Texas]. It was broad-based science with a teaching endorsement. I had minors in speech and psychology. I taught elementary school at the Air Force Academy for 8 years.

Researcher: The dependents?

Mary: Right, the schools on the base. There were two grade schools on the base and I taught senior officers quarters. I taught for eight years and it was absolutely fantastic. I took a lot of graduate classes at the [three separate Colorado universities] and some in Wyoming... After
being in Colorado I taught private school for awhile. . . . I took some Montessori type things. Then I worked a couple of years in hotel management. See, before teaching I had worked as a secretary and as an accountant in [specific city], at a couple of major hospitals and other businesses. After starting in [Present City], I decided to go back and get my Masters. I have everything done except for doing a paper. . . .

Researcher: How long have you been here, in [Present City]?

Mary: This is the fourth year. Two years at [previous school]; fifth one year and fourth the next. Then fifth grade here last year and then this year.

Researcher: Tell me a little bit about the classroom situation.

Mary: Ok. This is a self-contained homeroom, the children are with me throughout the day, except for part of the lunch period and the PE period, which is the last period of the day, from 2:45 to 3:30. Then they dismiss from the P.E. Room.

Researcher: So there are no other classes?

Mary: No other classes. They do not go to an art class or music class. I have them for all subjects. It was my choice. . . . So we do things a little differently. It's easier to do whole units of things than before, like science, social studies, and things correlated together. It's like having them here the entire day. One class may get lengthened while another is shortened, but there's no detriment because it does equal out.

Researcher: So you really do have quite a bit of freedom about it?

Mary: There's a lot of freedom of arranging. I do have a schedule that I turn in to the office, but they know that unless I know that a parent
does want to see a particular class I don’t stick that closely to the schedule. As long as the material is covered.

Researcher: How many students are in the class?
Mary: There are 27 at this time. One just came this week.

Researcher: If you had a choice of teaching any subject a majority of the time, or if departmentalization happened, what would you choose to do?
Mary: It would be science.

Researcher: Any particular reason?
Mary: My undergraduate was in broad-based science. Science is my field. I had a scholarship in pre-med, when I graduated from High school, because I did graduate at the top of my class. I had my choice of a couple of schools to do my pre-med work, but I got married. So, you know. I’ve had an interest in science all the way back. I didn’t go back to do my college work until after my children, I have two boys, until they were both in school and felt comfortable. Anything that grows or moves or wiggles I just enjoy watching. I would say, just an interest in that area. We did a lot of back packing. I did, at [previous school], science all afternoon everyday. Then last year, I taught all the fifth grade classes science. Math is my second subject. I’ve done quite a few graduate classes in that as well. But, I don’t have any aversion to other classes. That’s why it’s kind of fun to have self-contained because then I get to do it all. I miss not having all the students, because last year we did a Young Astronauts program and I have students from the other classes saying, “are we going to get to have it?” I can’t really do it for
them. I feel kind of guilty about that. Air and space is a big interest. I've gone to the last three years to the national convention for aerospace teachers. Then I went to Houston and took a two week training program at the Challenger Center at NASA. Then I went to the Biosphere outside Tuscon. I went to Pasadena, in the fall, in August, for the educators workshop. [reference is to the Jet Propulsion Laboratory during the Voyager fly-by] Actually, it wasn't part of the workshop but it was while I was there for the educator’s workshop. I went as a part of the Challenger Center to do research planning for workshops. I'm a regional representative for them now. It was kind of a spin-off of the Teacher in Space program. That's still in existence, but most of those teachers are conducting workshops in conjunction with having a class. I was not a Teacher in Space candidate. I wasn't even teaching at the time. [parents interrupt for a scheduled conference]

Before the researcher leaves a time is set for the first observation. The teacher is involved with therapy for some medical problems and will not be in class the next week. After checking the planbook and her schedule, a tentative time is arranged. The observation has been scheduled for November 29.

**November 29**

**Phone Conversation:** The morning before the observation, which was scheduled for the afternoon science period, the subject telephoned the researcher to say that she was going home with the flu. It was left to the discretion of the subject to contact the researcher, when appropriate, to
reschedule the meeting.

December 14

Scheduling Conference: The researcher stopped by Mary's school during her breaktime. Rescheduling the observation was discussed. Mary had gotten back to school only a short time before, and felt that she was really having to catch up on work, especially before Christmas break which would begin the 19th. We both felt that it would be more advantageous to observe after the students returned from vacation. The researcher informed Mary that she would call after Mary returned to school, January 2.

January 2

Phone Conversation: The researcher spoke to Mary at school, during the day. A visitation time was set during her science period on January 5. If anything changed she would call the researcher at home.

January 5

Classroom setting: The desks had been arranged in rows rather than in the groupings that were in place while visiting before Christmas. Mary explained that the set-up had been changed to facilitate work in preparation for the TEAMS testing and review for the test.

Bulletin Boards and Wall Displays: No changes were noted.

Learning Centers: None were noted at this time.

Visual Aids: None were noted at this time.

Classroom Observation: The specific lesson is on sound moving through
the air. A student brought a copy of the science manual, with the lesson marked, to the researcher during the class session. There were no specific references to aerospace activities noted in the textbook or teacher’s manual. However, during the hour lesson, there were several references made to aerospace, both by the teacher and by the students. Since the observation was being tape recorded, the specific instances appear in the following transcript. In this instance Mary was referred to as “Teacher”. The children were referred to by number. There were two specific instances during the 65 minute lesson. They were titled “Transcript #1” and “Transcript #2”.

**Pre-Observation Conference:** The teacher was still in the wheel chair, but could get up on crutches to move around the room while teaching. She had explained to the researcher, during a pre-conference before the science period, that it was still extremely frustrating to her to be so immobile and that she has had some trouble adjusting to the contained classroom atmosphere where she cannot do unit type activities with the whole fifth grade. She had yet to work on her “pet” Young Astronauts program because of not being able to be in contact with the entire population. The program had been only with her homeroom.

**Observation Transcript #1**  [This occurrence was noted close to the beginning of the lesson.]

Teacher: Give me some ways that tell me you can see air moving. Like the sound through the air that you’ve talked about.

Child 1: Like when you see an airplane moving. You can see those white things.

Teacher: Yes, contrails. Anything else?
Child 2: An airplane too, like when it takes off and they show those swirly things off the ends of the wings, with smoke or something. Like on TV when one of them crashes or something and they show how the thing shoulda moved.

Teacher: Yes, the movement of a vortex around the wing-tip.

Transcript #2 [This instance was noted later in the lesson after Mary had conducted an experiment illustrating sound traveling through various concentrations of air. The discussion centered around the principal of sound in a vacuum or partial vacuum. One of the children asked about sound traveling in a place where there would be no air.]

Teacher: Can sound be heard if there is no air? This about what Melissa said. Oh! What would happen on the moon?

Child 1: There's no air, you couldn't breath.

Teacher: No, I don't mean about being able to breath. Let's think about sound waves. [teacher calls on specific child]

Child 2: You don't have no---

Child 3: Oxygen. No! No! No!

Teacher: Be quiet and let them think. You said moisture, right. Gravity, no, there is some gravity. Think again. There are several people telling you that there is no oxygen on the moon. Is there an atmosphere? If I went to the moon, could I walk around with regular clothing on?

Child 2: Atmosphere!!

Teacher: What do you think happens to sound on the moon?

Child 4: [unintelligible]
Teacher: Yes! If I hit two rocks together on the moon what would I hear? [discussion] Ok, do you hear what she's saying? Do you agree with her?

Teacher: Ok, if I hit two rocks together on the moon what would I hear?

Child 5: Vibrations.

Teacher: Would I hear vibrations? Think about what she just said.

Child 4: Vibrations travel through air and there isn't any.

Teacher: If there were vibrations, what would they travel through?

Child 6: Nothing. We wouldn't hear anything, cause there isn't anything for them to go through.

Teacher: Could it travel through space, where there is no air?

[more discussion] ... I haven't gone up to the moon to see if that's what might happen. What do you think?

Child 7: Would you hear an echo?

Teacher: Could you hear an echo where there is no air? ... [discussion] Ok, you know sound travels through wood, it travels through metal, it travels through water, it travels through air. Think about the properties on the moon. ... [more discussion] Ok, he still thinks it's going to travel and that he's going to hear it. What do you think?

[teacher addresses Child 8]

Child 8: I don't think you'll hear anything.

Teacher: You don't think I'll hear a thing? Why not?

Child 8: Because there's no air. It can't vibrate through anything.

Teacher: You don't all seem sure about this. Think about it. How could we find out for sure? Give me one way we could find out whether or
not there is sound if there is no air.

Child 9: Look it up. Like in one of our moon books.

Teacher: Oh, look it up. So I have some books that I could use to research. Another way that I could do it.

Child 10: Go There!

Teacher: If I could be an astronaut, I could go up there and check it out.

Child 11: Well, go ask an astronaut!

Teacher: Well, ok, there are astronauts that we could ask. There are astronauts that have been on the moon. You know, we have the two or three astronauts' names that will answer your questions. I'll give you their names next Monday. A couple of you can write and ask them what happens on the moon. Because, I worked with a couple of them when I worked in Colorado Springs and they are friends of mine. They will answer our questions. I'll give you there names.

Child 8: [an aside while teacher is speaking] You've been telling us about all sorts of them guys this year.

Teacher: What other ways could I find out?... [discussion continues]

Post-Observation Conference: At the end of the lesson the teacher assigned each pair the task of finishing an outcome sheet. Each pair of children had to write an outcome of the lesson on how sound moved through air and then sign it. The researcher checked the outcome sheets. There were twelve pair of students. Two sheets, of the twelve, mentioned something concerning the impossibility of hearing sound on the moon because the sound waves or vibrations had no air or atmosphere to move through.
Conference Transcript:

Researcher: Is this something that you do after most lessons?
[reference is to the outcome sheets]

Mary: Yes, it seems to really give them closure and input into the lesson. When they are working in groups of two people or more, they'll have a recorder who will be responsible. It's all structured. But today there was no structure.

Researcher: Was this lesson something that came out of a science text?

Mary: Actually, there are only two experiments in the whole unit and the rest is just reading. There are so many in here who don't have sufficient reading levels to stay with us. Really, several non-readers. If I keep them with me with some real hands-on work, it really helps those who won't make it. There were some today who were not with me because I was the one manipulating the experiment.

Researcher: But they were still attending.

Mary: Oh yes, better than if you just handed them a book.

Researcher: So do you supplement a great deal just from your own background?

Mary: Oh yes. Oh, I have a lot of materials. Science is my major and I really like doing it. I've got books, ad infinitum, but I just think it's fun to tinker around. I think it makes for a more knowledgeable adult.

Researcher: What about the parents? Do they know what specifically happens in the science class? I noticed that your assignment was one that they would have to go home and try this weekend.

Mary: In this class if it's take home and read, I'll have a few that do it.
If it's like I did I'll have three-fourths that will do it. Even though most of them come from a single-parent homes and a lot are latch-key kids.

Now, every Friday I send home an assignment sheet. They have a letter to mom and dad; "this is what's going to be in science for the next week", "this is what we did this week", "here's the reading assignment", "here's the social studies assignment", and so on. So the parents, if they don't have time during the week, they can help them on the weekend with some of the reports or things. Today, since we're working on TEAMS, I did not make a big letter out. They wrote their own letter before lunch and we'll add the science before we go home. [The principal interrupted the conference. The teacher and researcher scheduled for a continuation.]

January 9

Post-Observation Conference (continuation):

An appointment had been made with the principal to enable the researcher to collect culminating data. For this reason it was felt that the teacher should be made aware of the actual intent of the study.

Transcript:

Researcher: Okay, I'd like to ask a few things about the lesson.

Mary: Ok

Researcher: Do you remember when you were talking about would there be sound on the moon, and asking if there was no atmosphere? You were asking them about ways that they could find out about it and you mentioned being able to write to a couple of the astronauts.
Mary: Yes, they could write to a couple of the astronauts.

Researcher: When you referred to Colorado Springs, was that when you were teaching there?

Mary: Yes, I also was doing work with some of the cadets and doing some work with some of their teachers. At the time, I did become pretty well acquainted with John Glenn and several of the other early astronauts.

Researcher: I have some questions about your lesson plans. This is the reason that I'd really like to study them. I noticed on one entry for the Young Astronauts that you wrote a notation for a Wright play.

Mary: Yes, that was the Wright brothers and they chose to do it as a playlet. We have one meeting each week and the children choose their own officers.

Researcher: Now I also have a question about when I went through the science manual. Did you do the units in order? How about the one on the universe? Did it come earlier in the year?

Mary: We did part of that unit earlier. You can see I did that before I broke my leg and it's still up there [teacher pointed to the planets that are taped around the top of the room] but we refer to it at our Young Astronauts meeting.

Researcher: I wondered because when you made a reference to something about the moon, one child made the comment that you used the models. I thought it sounded as if they used them before.

Mary: Yes, I didn't teach the whole unit, only part of it. We were going to go to the outdoor learning center, so I didn't do a tremendous
amount. But because we were going there I wanted to have them know the planets in order, a bit of time with the research that was coming back from the fly-by of Neptune and what they had discovered from the other planets. Because I had been in Pasadena during that conference and everything was so fresh and I had the newspapers. I had kept the clippings from out there plus here. We ran them off and talked about what it meant to us. But that was a rather informal thing. There were a couple of weekly readers that I used at that same time and I spent a little time telling them my background. At the first of the year I give them a rationale for setting up the clubs. We spend a couple of periods during science talking about why it's important to know the space program and what we're using from it. We sample some products that are currently on the market for public sell. Some that are an outgrowth of the space industry such as packs of the sealing food products. And some of the other items from the space industry. We talk about some of the adventures in space that had happened and why there was the lapse in time because of the accident. I kind of left it because we had two star parties lined up, one in October and one in December that I cancelled because of the break. I couldn't get down the steps to get outside. We had an Air Force Major that came in and did a presentation.

Researcher: Is that all in your science plans?

Mary: No, it's for the astronauts club. He came in and made a presentation. The rest of them were the children's presentations. It could have been something as simple as the Wright Brother's play.
We've had three plays that were from space adventures. One on Amelia Earhart, sort of with the radio communications. They did the Wright brother's program and they did the third one as a play that they wrote on a space program.

Researcher: This was the Young Astronauts?

Mary: This was done on that day that we would have Young Astronauts. They write to someone in the Air Force. It could have been on a military base. It could have been one of the astronauts at the space center or they could have written for materials. That was the third choice that they could write for, to one of the NASA offices. We did get posters back.

Researcher: All right.

Mary: The gentleman from the bank, that is our adopted school person, came one day because he had changed jobs and gone with General Dynamics. He came and brought materials from General Dynamics and did a presentation for Young Astronauts. I brought in books from the public library. . . . In the fall, when school first started, I brought in 40 books, three different times. There was everything to do with space that I could find. And they used those as their reading class selections for a week or two.

Researcher: Now was this the entire group?

Mary: Yes. Oh, by the way, when it says Young Astronauts that refers to the whole group.

Researcher: The whole class?

Mary: Yes, the whole class. . . .
Researcher: Are you doing anything specific after school with the Young Astronauts?

Mary: No, I'm not allowed to. We have too high a portion of our children who ride the bus. What I did last year, and what I will do this year, if there is anything in the city that the children can go to, I will arrange for tickets for the kids. Then they will arrange for car pools. I will arrange for low-cost car pools if they have trouble. Last year we went to hear an astronaut who is also an artist and he did a presentation. We had a NASA space mobile. They came and did a presentation at the science building. We had three science classes last year, and approximately half of them attended. We can't field trip, we're not allowed to pay for busing. So what I do is I arrange for things that are after school hours and then I let them arrange their own getting-there.

Researcher: Are the meetings basically one day a week?

Mary: Yes one day a week and I'm still doing that. I do have set up with the planitarium for a one day showing.

[At this stage in the conversation a custodian came in and began to vacuum. The tape was unintelligible. At this point the researcher explained the rationale behind the study. The researcher explained observing and interviewing to test for the specific outcomes of the aerospace workshop the subject had attended. Both the researcher and the subject agreed that it would be advantageous for the researcher to witness a Young Astronauts meeting in the classroom, since it was run as a total group project, rather than the after-school setting that was usually employed. The transcribed]
conversation resumed.]

Researcher: Let's begin with your rationale for taking the aerospace education workshop.

Mary: ... You know, when I taught at the Air Force Academy it fueled an interest that was always there. I was terribly excited about these planes and the kids whose parents went all over the world. It was very fascinating to me.

Researcher: Had you done anything, teaching-wise, with aviation before the Air Force Academy?

Mary: Before I went there, that's where I started, that was my second year of teaching. I taught first grade one year. So, even though my interest was there, I wanted to know what was around the bend. You know, it's all up there and you want to know. When the early astronauts went up I followed. Awww!! You know, what will happen next and what are they going to do. You know, you like it or you don't. And at the Air Force Academy the interest was extended by a lot of guest speakers and a lot of local things happening. I took my first "Air and Space" at [Area University C.]

Researcher: That was the first formal introduction?

Mary: Yes, the first formal class. I'd been to lots of air shows, lots of all kinds of other things, but no real instruction.

Researcher: Would you say there was anything that was especially from that class that changed any of your presentations?

Mary: Oh sure, oh sure, oh sure. It connected a weather study with it more than I would have prior to that. It gave me some ideas of using it
in other subject matters.
Researcher: More integration?
Mary: Right. But really teaching the air and space unit, it probably
didn't change it a tremendous amount. It gave me a few more
experiments to use and a little more hands-on materials.
Researcher: How about the Young Astronaut program? Is that where
you found about about that?
Mary: Yeah, I guess you could say that's where I found out. I think I'd
heard about it but I didn't see their programs until then. So yes, I say
the programs then. The air and space class, what it did more than
anything else though, is I became an auxiliary of the Civil Air Patrol and
got to do the fly-bys. That's not the right word. You know,
transportation on the planes.
Researcher: Are you referring to the airlift?
Mary: Yes, the airlift. That's the big thing.
Researcher: Have you been to any of the Congresses?
Mary: Right. This will be my fourth year at the National Congress.
Researcher: Have you decided to go to Reno? [site of the 1990 meeting]
Mary: You bet I'm going. I wouldn't miss it. You know if I have to take
off my time I will. The school district gifted department paid for the
three prior years.
Researcher: Was that also a direct outcome of the workshop?
Mary: Yes, that was a direct outcome of the workshop. Not only did I
go there, but we went to an airshow at Dayton and went to Washington
D. C. to the Smithsonian. There were some other trips that were also a
part of the class. I wouldn't have been knowledgeable of it happening of it if it were not for the class. That led into my deciding on my own, but I probably would not have known about it had I not been in the class. It kept me better informed with what NASA was doing. What kinds of programs were going on. Then I went to the week at Houston at the Challenger Center.

Researcher: You found out about the Challenger Center in the class?
Mary: Through being in the workshop I got on the mailing lists. Well not just the workshop but, it's like a chain letter. NASA, then through them the Challenger Center.

Researcher: The good old mailing list thing.
Mary: Yes. Then I went to the Biosphere at Tuscon. The people I met there, even though they were not with the Challenger Center, they were there. There were some college teachers and they only got it because they had gotten involved with all of this. Once there, I got a little more deeply involved on the Challenger list. It was just kind of, you know, like a snowball. In addition there's the aeronautics commission. I wrote some lesson plans for them. And the Texas Association of Aerospace Teachers [TAAT]. The one I've really stayed in is TAAT.

Researcher: The CAP helps a lot with that one doesn't it?
Mary: Yes. Now I've stayed a member of TAAT and I will stay a member of Challenger. I'm a regional person for the Challenger Center. They require quite a lot and you have to be pretty committed.

Researcher: As far as materials go, where would you say you got the greatest amount?
Mary: I won't say that I got the greatest amount from any one. I give a presentation at gifted workshops showing people all the places that you can go to get materials. The big three are NASA, the Civil Air Patrol and, and, now what is it?
Researcher: The FAA?
Mary: No the Air Force. Those will give me the most free material or the least expensive. Now going beyond that I can write to every state. I have the address for every state to write their person, like in Austin, to get materials. I have gotten materials from Austin. You write to whoever is in their state department. I can write to NASA at all the different places and I'll get different materials depending on which place I write. Depending on what they're using currently.
Researcher: All right, how about---
Mary: I also write to the Space Camps in Alabama and Florida. I will get materials from that. I will write to the Smithsonian. I'll get a different set of materials from them. I'll also write to people at colleges. Any college that offers classes in aviation and space science.
Researcher: Yes, the University Aviation Association.
Mary: Then I'll write to any that are using a Space Mobile to go from school to school. It just might be different from NASA. I will also write Beechcraft. They have an excellent book and I will write to, to, to, oh, who?
Researcher: Cessna?
Mary: Yes, Cessna. They not only have a book but also a plastic plane to demonstrate. I will even contact the Trekkies. Star Trek. I have a
lot of good materials from them. And I will also go to their little
conventions every so often when I get a chance, because there will be
some good little space vehicles. Then you find oddball places like, oh,
like just air carriers. American Airlines provides me with wings for my
Young Astronauts. . . . If you go to an airshow, United Parcel Service will
often have an exhibit there and you can get lots of little plastic
airplanes so the kids can use them to practice the various dymanics of
flight. I get a lot of books, like from Taylors Books or whatever.
Everytime I see something about air and space I buy it. There are
multiple places to go for this sort of material. It's not just the "big
three." Young Astronauts will send you material, the Challenger Center
has work, but they won't send it out to you. You have to go through one
of their workshops to get their material. If you go to museums, such as
Houston to the Challenger Center, you can see what they're doing and
they'll usually give it to you. I have two big books of their material and
how they set it up. Everything from how to set up a cooperative group
to where to send off to get the robots to do the stereo. You know, the
whole thing is there. You can get it from Houston and I have it from
Washington D. C. also.
Researcher: I understand what you're doing.
Mary: And it's not just science because I can't justify it only for science.
Because aerospace is not just science. It's social studies, it's timelines,
it's graphs, it's the newspaper. So it's reading material, language arts.
Researcher: Yes, language arts.
Mary: It's not only science. It's integrated. Air and space, just like a lot
of other topics can be extremely integrated. It can become a part of, well, you know, you breath it.

Researcher: How do you feel about the support—
Mary: HA.
Researcher: ---that you get administratively?
Mary: You don’t really want to know that.
Researcher: Yes I do, you know that.
Mary: Well, then I’m going to be really frank with you.
Researcher: Please do.
Mary: The science person for our district has been changed since this fall. The one who was the science person said, quote-unquote, “That has nothing to do with what you’re supposed to be teaching” and “you can’t teach that in first grade, second grade, third grade, fourth grade, etc.” So, we’d say, “But we’re not trying to, we’re just trying to use it wisely when it does seem appropriate.” Then we’d hear, “that’s taught in high school, or college, not in elementary school” That was the feeling.
Researcher: It can be a very common argument.
Mary: We asked for money to go to the things, or asked for a day off, or asked to make a presentation and it was put down totally. We were able to go to the conventions, another teacher and I, only because we used it in the gifted program. We were teaching, quote, unquote, "gifted kids". So, we could always say "they really need it", but that's not always true. So does the low kid. Even though they may never be an astronaut they need to know about the system they pay for. They need
to be aware that they may be a part of it too. They may be baggage handlers for American Airlines at the airport, they may be in a travel agency.

Researcher: It really all is a part of it.

Mary: Definitely. It all fits in.

Researcher: Is there anything that you can think of that could help ease that lack of support?

Mary: Education, period. Education on the part of their background. The one that's coming in now, [science coordinator] or has been there since fall that person knows how important it is.

Researcher: I will be interviewing her this week.

Mary: Good, that's necessary. I think you'll be impressed. There's a much more knowledgeable person. Knowledgeable about what's happening right now, not what was happening 40 years ago. I think that's a difference. It's a younger person, although not all people are that way. I don't mean that. I mean this one I think will be more excited about what's happening in the world in every area. We're talking about pollution. We're talking about taking care of our resources. We're talking about air and space. We're talking about the whole gamut. She's just going to be a different type of person to deal with. Hopefully, we will get more support. Support financially? NO! If I want a book I'll buy it, if I want the Young Astronaut program I'll pay for it myself. There's a forty dollar per year charge and I pay for it. I reach the point, with teaching in general where I end up spending a considerable bit of money for materials, but how would I get them
otherwise? And I believe, and other teachers who do the same thing obviously believe, that the extra expense is necessary.

Researcher: Is there anything specific that you would do to change the workshop or add to the workshop?

Mary: You mean the one I attended?

Researcher: Yes, specifically because that's the one that you have experience with.

Mary: Ok, I'll tell you that the one I took is different from the one in following years. We took it the first year they were offering it. We did it first as teachers, learning materials, and then we turned right around and taught it with the space camp. The camp was great. They were not able to have the camp again because of insurance costs.

Researcher: I had wondered about the reason.

Mary: They could not afford it. I think everyone who took it after that year did suffer from not being able to turn right around and teach what they had learned. I think they probably didn't utilize it as much because things you use right then you'll remember. When you get to that point in the book you're going to do it, automatically, without thinking.

Researcher: Are you aware of how many elementary people have taken the class in subsequent years?

Mary: I don't know about that. I have heard complaints that there was less hands-on and more "we've got to cover all this material." I think that's maybe that's true. I'm not certain because I've just heard it from people I know. But the first year we had a wonderful teacher. I can't
think of anyone who got more excited about learning than one of the people who was learning with us. . . . It was so new and she was so fresh. . . . I believe she got married after our class. She was teaching and enjoying it so. The classes have changed. I’m not sure whether it was so enjoyable then because she was doing it. Now I’m not sure if it’s because someone else was working with her or what.

Researcher: I think the professor has changed.

Mary: Yes, the professor has. There was a professor there at the college helping her teach it. The people who seem to come out of it now don’t seem to be as excited. I may be wrong. It’s more of a “do the assignment and learn the material.” When we took it it was explore, like, hey, will this work or try that. It was kind of a lot of fun. We had tests and they were fairly comprehensive. We took the book that’s used for ground school and covered quite a lot of material in it. But, the pressure was not on that. Seeing how you could do the experiments, how could you change it and what things did you learn from it. I liked that. Personally, that’s the kind of thing I like. I don’t want to be thrown all this material. I won’t remember that, but if you show me all the things and then let me try it, that’s different.

Researcher: Yes, the application of how you can use all the things makes it real.

Mary: We had a rocket launch and we had a Delta Dart and we had a balloon launch. It was great fun, you know. We had good friends in the class. It was very much a socialization thing. We truly enjoyed the process. I think if you learn it that way you’ll teach it to the children
that way.

Researcher: Yes, definitely.

Mary: I think I would have taught it to the children that way anyway, but I learned other ways of doing it that I hadn't thought of. So it was a valuable experience. Other than that I can't really think of anything that I'd add or change about the workshop setting.

January 18

**Classroom Set-up:** The class was still in the same configuration as it was during the earlier visit. The teacher still had her wheelchair at her desk but was moving around the room on crutches.

**Bulletin Boards and Wall Displays:** No changes were noted.

**Learning Centers:** None are noted at this time.

**Visual Aids:** None are noted at this time.

**Classroom Observation:** This meeting of the Young Astronaut chapter in the regular classroom was held during the normally scheduled science period. [Before the meeting began, the president approached the researcher and expressed some concern about the tape recorder being used during the session. He was to be in charge of the proceedings. The researcher decided to document the sessions with field notes only and not to use the tape recorder.] It began by the President calling the meeting to order. He then asked ten students to come to the front of the room. They were going to be presented their wings for having performed ten hours of service to the school. The President pinned the wings on each child. Then, the teacher led the group in the Young Astronaut pledge.
Mary's function at the meeting was to lead the group in making their "star finder" for use when they build their rockets. During the building of the astrolabe, the term used several times by the teacher, the children worked in cooperative groups of two. During the work session the teacher gave the class background information on the development of the astrolabe and explained to them that they would also use it in math discussion on angles and degrees so the measuring would be easier when the class fired their rockets off in the future.

Post-Observation Conference: The researcher asked the president what the members of the club had done in order to earn their wings. The president explained that the members had to perform school service, such as working as tutors for other teachers, being a crossing-guard before or after school hours, and performing other duties around the school building. The researcher then asked if they got a pair of wings for every ten hours of service. The president informed the researcher that after the members got their wings, they then earned a star for every ten hours of service. There was no limit to the number of stars that could be earned. He explained that some members sewed their wings on a patch and then sewed each star they earned around it.

Lesson Plans

Mary's lesson planbook contained twenty-three specific references to aerospace, within a sixteen-week period examined by the researcher. These specific references occurred in two subject divisions. One of the two specific division was a Young Astronaut Club segment each week, the other was
science planning. The activities included video tapes, guest speakers, written reports, art projects, a play, model making, and demonstration activities.

<table>
<thead>
<tr>
<th>WEEK</th>
<th>SUBJECT AND TOPIC</th>
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<tbody>
<tr>
<td>1</td>
<td>No specific aerospace reference noted</td>
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<td>2</td>
<td>No specific aerospace reference noted</td>
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<tr>
<td>3</td>
<td>Science: Young Astronauts, Astronomy</td>
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<tr>
<td>4</td>
<td>No specific aerospace reference noted</td>
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<tr>
<td>5</td>
<td>Young Astronaut Club: Guest speaker from General Dynamics</td>
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<tr>
<td>6</td>
<td>Young Astronaut Club: Study club pledge, pass out membership material</td>
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<td>7</td>
<td>Young Astronaut Club: Thank you note to guest speaker. Report on early air flight experiments.</td>
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<tr>
<td>8</td>
<td>Young Astronaut Club, Science: Study planet orbits and voyage to Neptune, make the measurements down the hall and illustrate the relative sizes of the planets, video from air/space tours in California.</td>
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<tr>
<td>9</td>
<td>Young Astronaut Club: Toys in Space, video demonstrating toys and hands-on use with toys in the classroom (space toys can be found in cabinet.) [note to substitute]</td>
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<tr>
<td>10</td>
<td>Young Astronaut Club, Science: Toys in Space, video continuation, Guest speaker in science, Captain Bradley</td>
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<tr>
<td>11</td>
<td>Young Astronaut Club: Wright brother's play</td>
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<tr>
<td>12</td>
<td>Young Astronaut Club, Science: Cosmos unit from Ranger Rick</td>
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<tr>
<td>13</td>
<td>Young Astronaut Club, Science: Cosmos unit from Ranger Rick</td>
</tr>
<tr>
<td>14</td>
<td>Young Astronaut Club: Classify flight card for designs, design the vehicles (cooperative groups), display and describe how they work.</td>
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WEEK  SUBJECT AND TOPIC
15  Young Astronaut Club: Model Day, 2 students demonstrate their personal collections for the class.
16  Young Astronaut Club. Math: Pin service wings, make simple angle/degree finders (astrolabe/star finder).

Mary's Principal

Conference Information: At the beginning of the interview Mary's principal, Mrs. Thayer, was not aware of the specific intent of the study. She had been informed earlier, by the district research director, that my observations would be for the purpose of investigating the science curriculum.

Interview Transcript:
Researcher: Do you notice anything unique about Mary's approach to teaching science?
Mrs. Thayer: Yes.
Researcher: Such as?
Mrs. Thayer: It's the most hands-on in the building. She has a foundation in science. I think she applies what she knows. She makes it so the children have to participate and it's much more participatory than most people are willing to risk at this point.
Researcher: How long have you two been working together?
Mrs. Thayer: Just since last year. We just opened this building last year.
Researcher: So had you had any contact with her before?
Mrs. Thayer: No, I hadn't even been introduced to her until that July.
Researcher: Is there anything you think you can credit the hands-on science approach to? Anything you know unique about her personality that might indicate why there's a difference in instruction?

Mrs. Thayer: I think she's very interested in science. She's very secure with it. That's what I noticed. She goes to every science workshop that there is. And because of her security with it and her knowledge and foundation in science that's the difference right there.

Researcher: I'm going to tell you some things that Mary is not aware of yet. I really am looking at her and her science instruction because she participated in an aerospace education workshop. I want to investigate whether the material was actually being used in her classroom. Have you noticed anything specifically related to aerospace that she might use in her classroom?

Mrs. Thayer: She did a rocketry unit at the end of last year. The children built rockets and we also set them off. So I know they did a lot of detailed work. I haven't observed any other specific aerospace work.

Researcher: How about her involvement with the Young Astronauts program?

Mrs. Thayer: Yes, yes, I failed to mention that. We had a Young Astronauts club last year. She has a self-contained class this year and she doesn't interact with the other classes as much as she would. I'm sure she's doing a lot of that with her own class. That's just a part of her, as a person.

Researcher: Did you have any comments from parents or other faculty about the aerospace specifically or about the Young Astronauts?
Mrs. Thayer: The parents were very pleased with the Young Astronauts mainly because not only the information they got but also because of the responsibility it places on the children, to do some community service. And in the end that fact that they were recognized for their participation and for their accomplishments. I think it's more the self-esteem thing than actually science.

Researcher: What are your feelings concerning the addition of aerospace things into the science curriculum?

Mrs. Thayer: I think that we need to take a look at the total picture. In other words, what we are trying to accomplish in the elementary school. We'll have to find out where it fits. The extensions that it brings, that's great, too. I think I need some more knowledge. I'll be honest, I'm not as knowledgeable as she is, by any means. So I'm probably not as aware as I need to be of the things that could happen. So you're working with a person here who has a general knowledge, but not a specific one.

Researcher: But, do you feel open to it?

Mrs. Thayer: Definitely, yes.

Researcher: If there were any type of in-service for administrators on integrating it into the curriculum, how would you feel?

Mrs. Thayer: See, I would have to go more general than that. I'm open to science, period, for administrators. So I can't limit it to aerospace.

Researcher: Do you think the science knowledge with administrators is limited at this stage?

Mrs. Thayer: It is for me. I mean I was a science teacher, but I didn't
have a tremendous knowledge of science as far as a background information other than participation in science courses through college and high school and that type of thing. It was not of great interest to me although I have fun with it. I think that may be our problem in the elementary schools. Maybe we're afraid of it. Maybe we're not interested in it. Maybe we don't have the materials. Mainly when I say that, not that we don't have the funding for the materials, but we don't take the effort to get all these materials together. It also takes a great knowledge of children and management of children.

Researcher: Yes. I think there we come to the hands-on approach. It can be something that makes them be out of their seats and can feel very disorganized.

Mrs. Thayer: Cooperative learning is helping that. The more they are secure with cooperative learning the more it fits. They still have to have materials for that group. They have to have an organized way for those materials to get to that group and back to where they need to be. And an organized means of reporting the information they gain. I've seen that type of reporting system with Mary....

Researcher: Have you noticed anyone else on the faculty picking up the aviation or aerospace activities because of what she's done?

Mrs. Thayer: She's working with a fifth grade teacher who didn't teach science at all last year. She's mentoring him so I think he'll probably pick it up.

Researcher: Nothing at any of the other grade levels?

Mrs. Thayer: No.
Researcher: Have you noticed a frustration, specifically with her having to document essential elements with the aerospace or having to qualify what she's teaching?
Mrs. Thayer: No, not at all. I think that documentation is something that everyone is concerned about in all subjects, no more so in aerospace.

School C

School C was in the adjacent school zone to school B. In fact, School B was built to alleviate some of the student-load for School C. School C was a neighborhood school with less busing that School B and a student population of approximately 300. It was located in a middle to lower-middle class socio-economic area in the midst of an older development of single-family homes. There were some apartment complexes in the area, but these seemed to have a more stable population that of School B. This kindergarten through sixth grade unit had a full-time principal and a vice-principal with duties as a classroom teacher.

Laura

This subject was included for interview purposes only. There were no classroom observation records, examination of lesson planbooks, or science textbooks for purposes of triangulation. Laura's principal was interviewed in order to provide some validation of the information. The researcher and Laura never met in person. Information was gathered only by phone conversation.
October 19

**Phone Conversation:** The researcher introduced herself and gave Laura some background information concerning the study. It was explained that the researcher wanted to observe the classroom during science instruction with possible visits in other subjects for correlative purposes. Laura seemed very reluctant about participation. She explained that she was now only teaching music education and was not in a contained classroom setting. The researcher told Laura that her previous classroom experience might still lend some valuable information to the study. The researcher asked to call her again next week to see if an interview time could be set. She reluctantly agreed.

October 25

**Phone Conversation:** Laura said that she would not participate because she was having some health problems. She was also having to put in a great deal of time at school working on the Christmas program with all the other grade levels. The researcher asked again if the study could be approached purely from an interview standpoint to obtain background information. She said since she was not going to participate in any observations that she really saw no reason for having an interview. Laura was then asked if she would feel more comfortable with the interview if she set a time-frame herself. It was agreed that she would feel more comfortable if there was not a set period of time in which to work. She told the researcher, if it was truly necessary, calling at a later time would be fine.
November 25

Phone Conversation: The call was initiated by the researcher. Laura was not at home so a message for a call-back was left. Laura returned the researcher's call immediately.

Conversation Transcript:

Researcher: I really appreciate the time that you're taking with me.
Laura: Well, I really don't see what difference this is going to make, since I'm not even teaching science this year. But I suppose if it will help go on ahead. I don't have much time so please be brief.
Researcher: Thank you. Do you see anything particularly unique about your approach to teaching science?
Laura: Well, I liked to get involved with the students. I suppose you could say, and I hate this because it is so over-used now, I guess I teach pretty hands-on. I don't like just theory, they need to see how it relates to now. How they can use it not just reading in the text and listening to me tell them how it might be.
Researcher: Did you use any subject matter that you thought enhanced, or extended, the text so you could make it more relevant for the children?
Laura: Well, I used to involve the classes with aerospace projects. I took a workshop one summer. Wait, you said you were interested in science. Is this really the workshop that you're talking about?
Researcher: To which workshop are you referring?
Laura: It's one of the only one's I've taken here. The aerospace workshop at [Area University C].
Researcher: If I had observed your classroom, I would have begun by looking at the techniques and approaches that you used in the science subject area and then continued to explore the other subjects. Yes, I am specifically looking for what outcomes there might have been from your involvement in the aerospace workshop.

Laura: Ok, now I see. Yes, I used a lot of the things from the workshop, but I really got involved with the Young Astronaut program. My principal really helped me. I had to have time after school.

Researcher: Even though you aren't teaching science, are there any ways that you try to sneak the aerospace in?

Laura: I'd like to, but I've been so busy with the program and I haven't been very well. If I can ever sit down and explore some material I might be able to. Look I really hadn't planned on talking long at all and I do have to go somewhere. But, please, could you call back after Christmas. I would like to share some ideas. Especially if it's something that might support this. I just can't now.

Researcher: I understand and I really appreciate your having called back. Certainly, I can call back after Christmas. How about if I call you in January, after you get back to school and have a chance to get back into the routine.

Laura: That really sounds fine.

January 4

Phone Conversation Transcript:

Researcher: I hope this is a convenient time for you.
Laura: It isn't particularly, but go ahead.

Researcher: When we spoke last, you said you had become quite involved with the Young Astronauts program, please expand on that if you can.

Laura: We met after school. It was not part of the school program. They had to have five dollars. That's what I bought materials and things with. I had more children than I had room for. So I put children on a waiting list and I ended up taking five more than the thirty I had planned for. They had to keep satisfactory citizenship grades. If they went below satisfactory, then I dropped them until they brought their citizenship up, and then they went on the waiting list.

Researcher: Were they one's that you might or might not expect to? Did it really keep the citizenship grades up?

Laura: Well, I think it did.

Researcher: There have been several things written about the ability of aerospace education projects to be used as motivators. Did you notice this sort of thing with this project with children that might have difficulty.

Laura: Most of them yes. They would try to keep their citizenship and conduct grades up. Most of them always had good citizenship anyway.

Researcher: Did you feel that you got a lot of support?

Laura: I had two mothers with me every week. They helped with the children. They were there until 5:00, let's see from 3:30 to 5:00. The parents would send snacks. They took turns sending snacks.

Researcher: How much support did you feel from your principal?
Laura: He love it. Part of the Young Astronauts tells the students they're supposed to be tutors.

Researcher: What about your educational background. Where did you get your degree?

Laura: At [Area University C].

Researcher: You have a B.A. degree?

Laura: I have a Bachelor’s of Music.

Researcher: Give me some idea of why you took the aerospace workshop that summer.

Laura: I was teaching science at the time and it was a six hour class for science credit that I could take. The gifted office would pay tuition and so, I took it.

Researcher: Had you been interested in aerospace education before you took the class?

Laura: No.

Researcher: No interest as far as a hobby or anything like that?

Laura: No interest in the education part. But I've always liked planes.

Researcher: So that was really your first introduction to aerospace education.

Laura: Yes

Researcher: Have you been to any of the Aerospace Education Congresses?

Laura: I've been to three of them. The last three since the workshop.

Researcher: Are you planning on the one in March this year?

Laura: I want to.
Researcher: Anything else with NASA, the FAA, or the CAP that you've taken advantage of since the workshop?
Laura: No, I've gone on a couple of field trips with the college. I went on one that summer. We went to Dayton to the Dayton Airshow. The next year, I was not in the class, but they asked if I wanted to go to D.C. to the Air and Space Museum.
Researcher: Where would you say that you got the majority of the materials that you've worked with in your classroom since the aerospace education workshop?
Laura: The Civil Air Patrol and NASA, also the FAA.
Researcher: As far as the textbook for science that you used in your classroom, was there anything specifically related to aerospace or aviation in the textbook.
Laura: No there was not and that was a problem because the director of science in [Present City] at the time--fortunately she's no longer there--kept saying that it was not in the curriculum. We kept saying, but fourth grade has a unit on weather and air and the fifth grade has a unit on planets and the solar system. She could not see it. What she was afraid of was that we would not be teaching the essential elements.
Researcher: One of my research question deals with wondering if aerospace education could be integrated into other areas of the curriculum. Did you find yourself using the aerospace education information in subjects other than science?
Laura: Well, what I did last year, in fact, the only other thing that I've done, besides science, was in language arts. I had a group of five
children who were just super advanced and did not really need any reading instruction. They could out-read me. I put them into researching and they worked on naming the shuttle. They did quite a bit of research into the names of the shuttles and the origins of the names. They put a lot of effort into making up new ones for more shuttle vehicles.

Researcher: Did you have any input from their parents on this extension?

Laura: Yes, they really thought it was a valuable activity. The principal was very supportive also, but no support from central administration because she was, well she--well--she's retired now.

Researcher: Thanks so much for the time.

Laura: You're quite welcome. I really hope it helps. I think it can really be so worthwhile. For instance, when we were studying the properties of air we make hot air balloons out of tissue paper. I'd try to time it so it would be when the air was cold outside. They did it in cooperative groups. The children loved it. We could work with committee properties and explore working as a unit. That's aerospace but nobody knows it. I think when we say aerospace they think you'll teach a child how to fly. Well, I did teach the parts of the airplane, but that's coincidental.

Researcher: Are you doing anything with Young Astronauts this year, even with the different teaching load?

Laura: No, I am not. I have a lot more and different responsibilities. I haven't thought as far as next year, but I have heard comments that the
parents and children and the principal are concerned because the program does not exist this year. We really have our necks up against the axe having to spend so much time, and document just how much time we spend doing certain things. If you can't document it in on our goals you can't do it. If it's not in the textbook they [administration] just don't think it should be taught.

Researcher: Laura, I can't tell you how much I appreciate your conversation.

Laura: You are quite welcome. I only wish I were doing something that you could come out and observe, but it just isn't possible. No matter how much I wish it were.

Researcher: That's no problem at all. I just needed to document some information.

Laura: Well, I wish it were more. Really, thank you and if I can help anymore please call me.

Laura's Principal

Interview Transcript:

Researcher: I just want to ask you a few questions about Laura. Did you notice anything unique about her science teaching techniques?

Mr. Mays: Laura is really an outstanding teacher. Everything she does she does well. Her science, well almost all her instruction, was some sort of hands-on approach. Activities or experiments. Something that would be very high interest for the children.

Researcher: Specifically, I'm looking at some of the outcomes of her
having taken an aerospace education workshop. Did you see the use of aerospace materials in her classroom?

Mr. Mays: Yes, I did. She had the Young Astronauts program also. Have you ever heard of that?

Researcher: Yes, I'm familiar with it.

Mr. Mays: Of course that was fourth and fifth grade students. A maximum of thirty that met with her one day a week after school for an hour. That also used aerospace information because of the title of that program and because of the interest it generated. She had a lot of activities that the kids did after school. They were really interested. Of course, they did the hot air balloons, kites and they did some activities I remember with a two liter coke bottle with hot water and air pressure. Boy, they'd shoot several feet into the air.

Researcher: Do you remember her using anything in her own classroom? During the instructional day?

Mr. Mays: The aerospace materials?

Researcher: Yes.

Mr. Mays: Charts, things like that. Now, let's see, of course she uses a lot of those things. I'm not sure what particulars for aerospace.

Researcher: Do you have any difficulty, personally, in integrating the aerospace into the regular curriculum?

Mr. Mays: No.

Researcher: Do you see any benefits to it?

Mr. Mays: Well, of course. It's one activity, one topic in science that children are very interested in and there are lots of technology and
inventions and so forth that have occurred over the last hundred years that are very important to our scientific world. I think it’s something that you can’t leave out of science. It has to be somewhere there to read.

Researcher: Did you ever notice any frustration on her part with any of the administrative detail that might put pressure on using aerospace?

Mr. Mays: Now, there were probably times when she did not do some of the aerospace activities because she had to attend to things from the essential elements. Of course she could do anything she wanted to after school. But during classtime she had to cover the essential elements. As long as she got those covered then she could cover aerospace things.

Researcher: Did you ever have any comments from parents, either positive or negative, concerning the aerospace activities that she was doing?

Mr. Mays: I don’t recall that. I had a lot of positive comments about her instruction in her classroom and also about the aerospace, the Young Astronauts that she did. The parents wanted their children in it and of course she had a maximum of thirty, but she also had a waiting list.

Researcher: Do you think it would be viable, if the essential elements were covered, to have some sort of addition of an aerospace technology to the science curriculum?

Mr. Mays: Yes, I really haven’t studied the science curriculum to see if it's included. I know it’s not included in fourth and fifth grade science.

Researcher: I think the only place where it is specified is in the secondary curriculum level.
Mr. Mays: It's often times very easy to look at the curriculum and see what needs to be added. But sometimes if you add something you have to eliminate some other things. It might be difficult, if I studied it, to see what would have to be eliminated.

Researcher: Do you see it more of an enhancement rather than a replacement?

Mr. Mays: Well, I would hoped that it would not have to replace anything. I would hope that we could see it before. I know teachers are bombarded with lots of things that they see as good things that are not in the curriculum but that can be taught anyway.

Central Administration

District Science Coordinator

The district science coordinator had been informed, by the district research director in October, when the study began, that the researcher would be observing and interviewing teachers to examine practices utilized in the science curriculum. When the researcher met with the coordinator, in January, time was spent reiterating the process and goals of the study.

In examining copies of the adopted science text, the researcher found that 1984 was the most recent copyright. At the beginning of the interview the researcher queried the coordinator concerning the dates of adoption. After having searched through several files, and other text suggestions, it was confirmed that the 1984 text was the most recent science text adoption for the entire district. With further conversation, it was established that the textbook adoption process was completed in a six-year cycle. The district
was about to undertake the beginning of the next six-year cycle by forming committees in the spring. This meant that the adoption process would begin in January, 1990, but the teachers would not have a new textbook until the 1991-1992 school year. A great deal of time was spent in conversation concerning the district and state guidelines for science text adoption policies and procedures. Pertinent conversation concerning the applicability to aerospace education, and it's relationship to the science curriculum, was included in the transcript.

**Interview Transcript:** During the conversation Mrs. Dowd referred to a proclamation from the State Board of Education concerning textbook adoption guidelines. A copy of the portion of the proclamation dealing with Earth Science content may be found in Appendix C.

Mrs. Dowd: For science, that's critical that it remain a six-year cycle, because we don't want our books to become obsolete any faster than they are. So much of the technological breakthroughs aren't included and discussed if they aren't right there in the textbook. It is very involved. Let me see if I can find the proclamation for new bids on texts that comes from the State Board of Education. [coordinator continued to search for guidelines]

Researcher: I had no idea that the process was that involved as far as that long a period of time between adoptions. I've given you background concerning the study, but I actually have been looking at the specific outcomes of these teachers who took an aerospace education workshop. My research questions dealt with their actual use of materials and methods obtained during the workshop.
Mrs. Dowd: I'm not familiar with the workshop, however I do know there is some interest from some of our faculty.

Researcher: Now, if I am correct, this is your first year in this position.

Mrs. Dowd: Not even a year. Really, just since August. As of August 31.

Researcher: Specifically, what are your views concerning aerospace education?

Mrs. Dowd: The space and the technologies are areas that we just have to keep increasing. I mean, you're talking about preparing these kids for the future. If they don't have the information related plus the space you know we may have all kinds of space stations and space manufacturing. In fact, like for example, the drug companies. If they could have a drug lab up there, they could have a sterile environment and a controlled environment. They could go on and prepare drugs and chemicals in that atmosphere. We're talking about our kids now. Of course, it would be a select few for some of it. But you want also a group to be favorable to space type explorations, experiments and so forth. Because there are benefits from that. It's not just science fiction. And I think that the kids need to be aware of that.

Researcher: Do you think that the text books as they stand now, and one's that you're going to be looking at, present it adequately?

Mrs. Dowd: No, I think they could do a better job. I think much of the textbook companies tend to be very traditional. One of the things we need to push is to move a little faster into the next century. I think we need more related to technology. You've seen an improvement if you look at the textbooks. They're slowly adding on, but I think they need
to do a better job of relating it to not so much theoretical, but relate it to things that the kids can actually relate to. Go ahead and dream about the space stations and the types of things that take place there. Such as the living conditions, the types of experiments and benefits and so on, the things they can relate to. Not the real abstract stuff. That has no meaning to the kids. Of course if you look at TV, the things that we have on, the science fiction that we're seeing. You may think that's way off, but it's not. So why not? I mean you're going to capture a student's attention if you talk about something that they can relate to. Show how that relates to science and their lives, to the future and so on. We need more of that. Oh, maybe it's getting better.

Researcher: Do you see any changes coming with gearing any of these advances into the essential elements? The only place I've really seen aerospace mentioned is at the secondary level.

Mrs. Dowd: I have not seen any examples of texts. [looking for proclamation] Again, this is process science where the kids do need to learn about the skills. Here it is. Let's look at the content that they put in for earth science. They have astronomy, space science, meteorology, all this content. [coordinator gives a copy of the textbook proclamation to the researcher for review]

Researcher: What about the specific topic dealing with space concepts? Was that not there before?

Mrs. Dowd: No, I don't believe that it was. I don't have a copy of the old proclamation. Look, they even have space ethics. . . . [reads passage]

Researcher: I wonder how they define space ethics? . . . That really is a
new addition.

Mrs. Dowd: They're changing and we don't know specifically what they mean when they say... [reads passage]... What do they mean by the word "emphasis", yet they still ought to have a balance. We've asked for clarification.

Researcher: I've spoken to all of the principals. They've been supportive, in reference to the use of aerospace, but all have been very concerned about the aviation or aerospace education under the dictates of the essential elements.

Mrs. Dowd: The essential elements, from what my understanding is, are going to become devoid of content in terms of our curriculum. Which leaves it open to decide what particular content do we want in the different grades and so on. The only thing that would kick this back is in terms of the Texas assessment tests, [discussion continued about the hands-on verses content question] The specific testing of process versus content is a problem. If the student has had textbook experience and that's all, they are not able to do that process testing. Whereas there aren't many areas that use the hands-on testing to decide the outcome of completion of curriculum.

Researcher: There seems to be a little more acceptance, concerning aerospace education, as long as it stays as an enhancement, or part of a gifted program. When it is used as something that's extra rather than something basic.

Mrs. Dowd: I think that's because traditionally it was not included in the book and many of our teachers feel tied to saying, "I have to cover
this book, I don’t have time for anything else.” We’re trying to promote the attitude in the district that NO you don’t cover the book. That there are critical areas that should be taught, and there’s just no way you can do it justice if you just merely run through the book. Students just don’t retain something unless you can give them application to experience or hands-on stuff. Then they retain it. I would like to see, and I don’t know how long it would take reality to have this happen, all over the U.S. they’re working on a content-slash-process type of curriculum. In other words they’re trying to teach different conceptual themes. Like they might have one just on space or on electricity. Main concepts instead of just teaching a lot of stuff. They might pick out concepts for different grades. Maybe the concepts are spiraled and you get an increase in terms of depth. They’re saying that we need to teach less. But that less that we teach needs to be in greater detail so that the kids retain it. So we’re saying in order to do this you’re going to take broad concepts and tie it to a number of things. Then the student has the conceptual framework. That the student has it if you give them framework, or something to tie things on, it’s going to stay longer than if you just go through a lot of disconnected things. So, that’s why they’re proposing that in terms of the journals and literature that’s coming out. 
Researcher: It seem to be more of an integrated approach. 
Mrs. Dowd: Yes, that’s right. Definitely.
Researcher: I have seen many of them using aerospace in many more areas. Not just science instruction. 
Mrs. Dowd: Sure, science, social studies, math. See, those are things that
would lend themselves to an integrated curriculum. It touches all the other areas. In fact, they're [researchers] saying that learning is that way. We just don't have a little narrow tunnel that covers just one part. It all reaches out and touches a number of things. Space is a very important area for us to look at and it's very exciting for those kids. It may not be exciting for the teacher who wants to teach things the way they did before. But it's exciting. Especially if you can teach it with some hands-on activities that they can relate to. If you're only teaching space and you're talking about something abstract, way out there, then the teachers aren't going to like it and the kids aren't going to like it. It has to be with the hands-on type of thing.

Researcher: Do you know if there have been any requests to your office specifically for aviation or aerospace materials?

Mrs. Dowd: You're probably asking the wrong person because history. . . . I would say by the way this office was structured. . . . Based on that I don't think this office was recognized as a place to necessarily ask for things, part of that perspective may have conditioned them. Now, that might be different if we were to do an in-service.

Researcher: Do you see that as a possibility?

Mrs. Dowd: Yes, that's always a possibility . . . .

[Coordinator discusses district policy concerning in-service opportunities and her attitudes about what should be included for a valuable experience.]

Mrs. Dowd: I think that's the thing that makes the difference, especially if the teacher is not too crazy about teaching science. They want some hands-on activities that they can get the kids to do and the kids
succeed. They're successful and the kids are interested in it. They feel good at the end. Because, if a teacher has to fight to teach it, they probably won't teach it more than once and then say, "ah, that didn't work, we won't do it next year." But if you get the right combination; they can go to an inservice, they enjoyed it and they can say this is really neat and I can hardly wait to try it with my kids. Because they were successful when they tried it, and they were successful when they tried it with their kids. They're going to try and repeat that. It's a matter of survival really.

Textbooks

The textbook used by all the subjects was a district-wide adoption. The copyright date for this particular series was 1984. The district is involved in an adoption process for a new textbook. The new proclamation guidelines for text adoption, specifically those concerned with earth science, are included in Appendix C.

The second grade textbook contained some specific references to aerospace matters in the chapter dealing with weather. In an illustration of people involved in science activities, there was the introduction of a female air-traffic controller. Text was concerned with how the controller helped aircraft to fly safely through adverse weather conditions. The "Teaching Tips" section suggested that the teacher ask the children if anyone had ever flown in a plane and to allow the children to share their experiences. An extension tip for the chapter activities was to make kites from paper plates. One incidental reference occurred on a title page for a chapter with the
inclusion of a picture of a hot air balloon.

The fifth grade textbook which was examined, contained specific information in three chapters which dealt with the solar system and exploring the universe. Much of the information contained in these chapters appeared exactly as it might in many NASA publications. Specific reference credit was given to NASA and the Air Force for many of the pictures.

Aerospace/aviation information also occurred in two other chapters. In a chapter dealing with the ocean and pollution, there was a picture of a crop dusting aircraft, accompanied by text discussing the effects of chemical spraying on the environment. In another chapter, dealing with how sound waves traveled, there was a picture of the Concord Supersonic Transport plane, accompanied by text discussing supersonic speed and the causes of sonic booms. Several review questions and test questions, for the specific chapters and units, dealt with the affect of aircraft and rocket flight on sound and air waves.

An outline of specific content for the textbooks investigated is included in Appendix C.

Presentation and Analysis of Data In Relation to the Research Questions

What aerospace materials, if any, were being used in the classrooms of teachers who had attended an aerospace education workshop?

Aerospace materials were being used, or in the case of Laura, had previously been used, in the classrooms of all four subjects. Some of these
materials were also utilized in after-school programs. The specific materials fit into many categories and were often used differently in each of the classrooms in question. The materials listed in Table 1 were noted by researcher observation and, in cases where direct observation did not yield information, teacher disclosure was the means of data collection. There may, in fact, be more materials utilized than the listing reflected. The materials listed did not include specific activities. They were listed as broad categories only.

Table 1

<table>
<thead>
<tr>
<th>Aerospace Education Materials Utilized in the Classrooms of the Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Materials</strong></td>
</tr>
<tr>
<td>Teacher-made curriculum materials</td>
</tr>
<tr>
<td>Computer assistance</td>
</tr>
<tr>
<td>Young Astronaut Program activities</td>
</tr>
<tr>
<td>Civil Air Patrol: Falcon Force Box</td>
</tr>
<tr>
<td>Rocket building</td>
</tr>
<tr>
<td>Supplementary reading books</td>
</tr>
<tr>
<td>NASA posters</td>
</tr>
<tr>
<td>Aerospace video/film activities</td>
</tr>
<tr>
<td>Supplementary worksheets</td>
</tr>
<tr>
<td>Specific display models</td>
</tr>
<tr>
<td>Newspapers</td>
</tr>
<tr>
<td>Weekly Readers</td>
</tr>
<tr>
<td>Organization newsletters</td>
</tr>
<tr>
<td>Tape Recorded lessons</td>
</tr>
<tr>
<td>Other commercially produced materials</td>
</tr>
</tbody>
</table>
In which subject areas did these same teachers choose to use aerospace education materials? How were the materials presented to the students?

In examining the teacher’s lesson planbooks it was first necessary to establish some common foundation for defining the subject headings. Some of the teacher’s defined language arts as a separate category in which reading and spelling were included, others listed each subject separately. The information presented in Table 2 is a reflection of establishing this common ground.

Table 2

<table>
<thead>
<tr>
<th>Subject Area</th>
<th>Norma</th>
<th>Paula</th>
<th>Mary</th>
<th>Laura</th>
</tr>
</thead>
<tbody>
<tr>
<td>Language Arts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reading</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Handwriting</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Spelling</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creative Writing</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Research/Report Writing</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Math</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Social Studies</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Art</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
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<tr>
<td>Physical Education</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

The second section of this research question entailed examination into the methods of material presentation utilized by the subjects. In discussion, after observations, the teachers gave rationale for many of the methods.
Some of these methods were emphasized in the textbook, while others were utilized because of background experience on the part of the teacher. This section was also influenced by the types of student-output for each approach. During this process the researcher observed some of the testing procedures involved with different methods of presentation. Most of the activities were hands-on and involved testing of the process, rather than a strict emphasis on production of a common product. As seen in Table 3, the methods of presentation were similar for each of the four subjects.

Table 3

Methods of Presentation For Aerospace Materials

<table>
<thead>
<tr>
<th>Method of Presentation</th>
<th>Norma</th>
<th>Paula</th>
<th>Mary</th>
<th>Laura</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulletin boards/wall displays</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Learning Centers</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooperative groups</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Large group lecture</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Individual student research</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Model demonstration by teacher</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Classroom demonstration by student</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>&quot;Hands-on&quot; discovery by student</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Video/film assisted introduction</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

Since each of the four subjects taught in a contained-classroom setting, they had control over the presentation of material and the follow-up activities assigned. Many of the activities were carried over a period of time ranging from one to three school weeks. The on-going nature of these projects often was the catalyst for the creation of new, inter-related projects as listed in Table 4.
Table 4

Student Activities/Projects Related to Aerospace Education

<table>
<thead>
<tr>
<th>Activity/Project</th>
<th>Norma</th>
<th>Paula</th>
<th>Mary</th>
<th>Laura</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creative story writing</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Written reports</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Oral reports</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Query letters</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Designing cloud/weather charts</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full-sized self-portrait as an astronaut</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
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<tr>
<td>Designing solar system model</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Worksheets</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Space vehicle models</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paper airplanes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hot air balloons</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Rocket launches</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Design a space station</td>
<td></td>
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<tr>
<td>Poetry</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Play presentation</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Young Astronaut Program activities</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Puzzles</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Timelines</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dioramas</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Space food tasting</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Astromomy star parties</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

Did the aerospace education workshop help provide sufficient educational materials for the teacher's use? What specific agencies have provided materials?

Each of the subjects stated that a strength of the workshop was having provided a means of obtaining educational materials. The mailing lists which
the subjects were placed on appeared to have generated much of this contact. However, as illustrated in Table 5, each of the subjects had also done work on their own in discovering new means of obtaining information and materials related to aerospace.

Table 5

Specific Sources Used to Obtain Aerospace Education Materials

<table>
<thead>
<tr>
<th>Source</th>
<th>Norma</th>
<th>Paula</th>
<th>Mary</th>
<th>Laura</th>
</tr>
</thead>
<tbody>
<tr>
<td>Civil Air Patrol</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Federal Aviation Administration</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>NASA</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Estes Rockets</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Delta Dart model airplane</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Space Foundation</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
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<tr>
<td>Texas Association of Aerospace Teachers</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Cessna Aircraft</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Beech Aviation Corporation</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
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<tr>
<td>Jet Propulsion Laboratories</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>American Airlines</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Challenger Center</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>General Dynamics Corporation</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Simuflite</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>United Parcel Service</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Challenger Center</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Airshows</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Young Astronaut Program</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Museums</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Private companies, not specifically named</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Teacher-Made</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Table Continues
Table 5

Specific Sources Used to Obtain Aerospace Education Materials

<table>
<thead>
<tr>
<th>Source</th>
<th>Norma</th>
<th>Paula</th>
<th>Mary</th>
<th>Laura</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Congress On Aviation and Space Education</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>International Young Astronaut Convention</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Space Camp</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Conventions (other than above)</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Star Trek</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Air Force</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Bookstores</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>State aeronautic commissions</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>State departments of education</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Smithsonian</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

What enhancements did the teachers use in conjunction with the aerospace education material?

This material included field trips, speakers, or anything which might not be included in material obtained through the mail. Many of these enhancements were contingent upon the teacher’s contact system outside of the school setting. This also seemed to be an area where the teachers utilized the parents of their students in the role of "resource person." The administrators were aware of this action and commented on the involvement of the parents in the use of aerospace materials as an addition to the regular curriculum. Mary expressed concern for use of these enhancements, which she also noted were vital to the application of this subject matter, when they entailed the use of extra funds or after-school participation. She had begun
to use the Young Astronaut Program activities during the school day, instead of an after-school program, because of these concerns and specific dictates from the administration. Many of the enhancements, or extra activities, were paid for by the teachers themselves. However, the teachers noted that they usually tried to find the sources for materials which were provided cost-free or required only a minimal charge. Mary mentioned organizations which had donated tickets, or helped to defray the costs, for some of the enhancement activities in which her class had been engaged. Information in Table 6 details both specific enhancements, and broad categories of activities which were used as enhancements.

Table 6

Enhancements Used in Conjunction With Aerospace Education

<table>
<thead>
<tr>
<th>Enhancement</th>
<th>Norma</th>
<th>Paula</th>
<th>Mary</th>
<th>Laura</th>
</tr>
</thead>
<tbody>
<tr>
<td>Video tapes</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Films</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Computers for instructional purposes</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>On-line computer capabilities for planning</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Television</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Fieldtrips</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Planetarium</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Visit to artist/astronaut</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Trip to NASA</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Guest speakers</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Hot air balloon launch</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Presentation of plays</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Airshows</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

Table Continues
Table 6

Enhancements Used in Conjunction With Aerospace Education

<table>
<thead>
<tr>
<th>Enhancement</th>
<th>Norma</th>
<th>Paula</th>
<th>Mary</th>
<th>Laura</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rocket launch</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Posters on aerospace</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Hands-on experiments</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Books</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>NASA Space Mobile presentation</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Star parties</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

What effect had attending an aerospace education workshop had on the teaching practices of the teachers involved?

The practicum experience, associated with the workshop which the four subjects had attended, was mentioned by each of the subjects when queried about the direct outcomes of the workshop. [It was the understanding of the researcher that the practicum was no longer a part of the workshop experience.] Paula and Mary both recommended that the reinstatement of an experience, where hands-on practice of materials was utilized, should be of prime concern. This same experience was attributed with easing the fear of using new materials and proved to the subjects that aerospace principals could be taught, effectively, to elementary students.

Direct outcomes of the workshop included: new materials, new sources for materials, specific science instruction tied to other areas of the curriculum, introduction to the Young Astronaut Program materials, inclusion on a mailing list which in turn generated new sources of information,
introduction to NASA materials, and available membership in the Civil Air Patrol.

The membership in the Civil Air Patrol was a necessity for workshop members in order to take advantage of airlift benefits with the Air Force. This means of transportation was arranged by the Civil Air Patrol for fieldtrips to airshows, visits to the Smithsonian and other air and space museums, and was a means of primary transportation to the National Congress on Aviation and Space Education. This convention was a joint effort of the CAP, NASA, and the FAA. Paula, Norma, and Mary expressed concern that the airlift, and the fieldtrips associated with it, remain a specific inclusion in the workshop program. Paula and Mary specifically mentioned that the nominal fee for membership in the CAP more than paid for the benefits, especially from the stand-point of being able to join in the airlifts.

What effect did administrators have on the use of aerospace education materials, practices, and perceptions of the teachers being studied?

The ability to show documentation, specifically concerning the teaching of state mandated essential elements, was a concern to administrators and teachers alike. The administrators expressed concern with accountability and the teachers expressed concern with the pressure they felt in having to document something they considered so worthwhile.

However, the administrators also exhibited a great deal of support toward the Young Astronaut Program activities. They approved of the program, whether it was after school or during the classroom period, because of parental involvement and student outcome.
Table 7 enumerates the concerns and perceptions of the role aerospace education for the teachers and administrators in Building A.

**Table 7**

Building A: Administrative/Teacher Perceptions Concerning Aerospace

<table>
<thead>
<tr>
<th>Concern/Perception</th>
<th>Norma</th>
<th>Paula</th>
<th>Principal</th>
<th>Coordinator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Young Astronaut Program is valuable</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Material must be taught &quot;hands-on&quot;</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>In-service opportunities should be available</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Aerospace only as an enrichment subject</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Correlation with other subjects necessary</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Documentation [Essential Elements] necessary</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Aerospace as a motivator/incentive</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Parental knowledge/involvement necessary</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Teacher input into curriculum needed</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Administrative support available</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Financial support necessary</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Specific materials must be available</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Norma was the only teacher to state that she felt there was adequate support from the administration. However, she qualified her statement by saying that she believed in order to receive that support, a teacher needed to be able to present an argument for the material with a great deal of documentation and background. Paula stated that she felt support but also gave examples of instances where she’d had to defend her use of, and interest in, aerospace education materials. The instances concerning her defense came during discussion of financial support for extra projects for teachers, such as in-service opportunities outside the districts, and purchasing of materials for student use.
Table 8 enumerates the concerns and perceptions of Mary and her principal at Building B.

Table 8

**Building B: Administrative/Teacher Perceptions Concerning Aerospace**

<table>
<thead>
<tr>
<th>Concern/Perception</th>
<th>Principal</th>
<th>Mary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Young Astronauts Program is valuable</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Material must be taught &quot;hands-on&quot;</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>In-service opportunities should be available</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Aerospace used as an extension to the curriculum</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Aerospace is not just an extension to the curriculum</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Effort must be made to provide specific materials</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Administrative support is necessary</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Financial Support is needed</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Documentation [Essential Elements] is necessary</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Teachers should have input into curriculum</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Must have a knowledge and foundation in science</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Must feel secure with subject being taught</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Children need a bridge to technological subjects</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Aerospace topics should be taught to every child</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Mary and Laura were both concerned about the lack of administrative support. Mary was less concerned about the documentation aspect of pressure from the administration than the other three subjects. However, she was more apprehensive about the support, financially and logistically, related to obtaining new or updated materials within the district.

Table 9 lists the specific concern from Laura and her principal. It should be noted, when examining information in this table, that Laura was not teaching in a contained classroom and had not been able to use any of
her aerospace material from previous years. She had not had the opportunity to try and use some of the aerospace education material in her present music class set-up. The Young Astronaut Program that she had conducted during the previous years had not been active so far this school year because of the additional duties and programs which she had to be responsible for. Laura expressed concern over the amount of documentation necessary and the lack of concrete teaching material related to the adopted textbook in reference to her previous years experiences.

Table 9

**Building C: Administrative/Teacher Perceptions Concerning Aerospace**

<table>
<thead>
<tr>
<th>Perceptions/Concerns</th>
<th>Principal</th>
<th>Laura</th>
</tr>
</thead>
<tbody>
<tr>
<td>Young Astronaut Program is valuable</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>&quot;Hands-on&quot; approach is necessary</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Aerospace is an enhancement, not a replacement</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Aerospace is a motivator/incentive</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Essential Elements must be covered first</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Documentation is a concern</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>In-service opportunities should be available</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parent comments are necessary</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Materials and financial support must be provided</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High interest approach is necessary</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Technological issues must be addressed</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

Paula, Mary, and Laura made specific comments concerning having had contact with the previous science coordinator. Mary expressed interest in the changes which might occur with the advent of a change in the central office administration. Table 10 enumerates the concerns and perceptions of
the science coordinator. It also lists the dictates on science information coming from the state concerning new content adoption policies.

Table 10

Science Coordinator: Administrative/State Perceptions Concerning Aerospace

<table>
<thead>
<tr>
<th>Concern/Perception</th>
<th>Coordinator</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instruction should be &quot;hands-on&quot;</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>In-service opportunities should be available</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>An integrated science approach is necessary</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Textbooks be recent enough to stay up with technological breakthroughs</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Students must be prepared for technology of the future</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Students must be aware of benefits from space exploration</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Traditional textbooks need to move forward more quickly</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Science needs to relate to student's lives</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Critical areas, outside the textbook, need to be taught</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

Demographic Information

During the data collection certain types of information came to the attention of the researcher. Although it did not relate specifically to the research questions it is germane to include it at this point because it was a qualitative study.

It is necessary to mention, for the purpose of background information, that the aerospace workshop which the subjects attended was worth six hours of graduate credit in science. The two-week workshop accounted for three of those hours, with an additional three hours for taking the optional
practicum experience.

Table 11 presents the demographic information for the four subjects. Mary was the only subject with a formal degree in science. Each of the other subjects has a Bachelor's Degree in some education field: Laura's degree is in music, Norma's is in elementary, and Paula's degree is in kindergarten and primary education. Laura has a Master's Degree in education and Paula has a Master's Degree in reading.

Table 11

Demographic Information Pertaining to the Four Participants

<table>
<thead>
<tr>
<th>Information</th>
<th>Norma</th>
<th>Paula</th>
<th>Mary</th>
<th>Laura</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDUCATION:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bachelor's Degree</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Master's Degree</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Graduate Credit Hours:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science</td>
<td>21</td>
<td>13</td>
<td>21</td>
<td>6</td>
</tr>
<tr>
<td>DISTRICT IN-SERVICE: As a Presenter</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>As a Participant</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Curriculum Writing</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>OUTSIDE IN-SERVICE: As a Presenter</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>As a Participant</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Curriculum Writing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONFERENCE ATTENDANCE:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>National Science Teachers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>National Congress on Aviation and Space</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Texas Association of Science Teachers</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Table Continues
Table 11

Demographic Information Pertaining to the Four Participants

<table>
<thead>
<tr>
<th>Information</th>
<th>Norma</th>
<th>Paula</th>
<th>Mary</th>
<th>Laura</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CONFERENCE ATTENDANCE:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tucson Biosphere</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Jet Propulsion Laboratory Workshop</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>International Young Astronaut Convention</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Challenger Center Workshops</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>WORK EXPERIENCE:</strong> [Built chronologically from college graduation]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full-time teaching (at graduation)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Full-time parenting (sabbatical taken from work experience)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Sunday school/Pre-school teaching</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work outside the teaching field</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Full-time teaching</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>PERSONAL:</strong> Marital Status</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Divorced</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
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<td>Children</td>
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<td><strong>Family Participation in Aerospace:</strong></td>
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<td>Conference attendance by family</td>
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<td>Spouse’s Profession related to area</td>
<td>X</td>
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<td>Assistance with school projects</td>
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<td>General interest in aerospace</td>
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<td>Child has pilot’s license</td>
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CHAPTER V

FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

This qualitative study was conducted in a large north Texas school district. The data collection focused on the use of aerospace education materials in the classrooms of four elementary teachers who had previously been students in an aerospace education workshop. Each subject, their school, and the administrators interviewed were given pseudonyms for reporting purposes. Data collection was accomplished through interviews, observation, and artifact collection from the teachers, the various building administrators, and the district science coordinator. The study examined the subject areas in which aerospace materials were used, how these same materials were presented to the students, whether the workshop had been beneficial in providing the teachers with materials, and specifically what agencies had had been utilized by the teachers to find materials. Enhancements to the aerospace education materials were also examined. The study further questioned the effects of having attended an aerospace education workshop on the teaching practices of the subjects involved. District administrative effects upon the practices and perceptions of teachers utilizing aerospace education concepts in their classrooms was also a focus of the study. Since the study in question was qualitative in nature it would be unwise to generalize to other settings.

It must be noted that the data gathered from Laura was solely by
means of interview. Any information gathered from Laura did not have the possibility of corroboration by direct observation since she was teaching music, not science. Her principal was interviewed to provide some validation for her input. It was possible that she utilized more aerospace information and materials than the researcher was able to report because bulletin boards, learning centers, and related materials were not in evidence during the interview.

Findings

What aerospace materials, if any, were being used in the classrooms of teachers who had attended an aerospace education workshop?

The researcher entered into the study originally questioning whether a participant in an aerospace education workshop actually utilized aerospace materials presented to them in the class. Each subject, in their initial interview sessions, volunteered an affirmative answer to this question without the researcher ever having to directly ask. The materials were divided into broad categories which were able to support several activities. These specific activities or projects were dealt with in a subsequent research question. In cases where direct observation did not yield information, or in the case of Laura who was not observed at all by the researcher, teacher disclosure was the means of data collection.

Norma utilized ten different categories of materials while her building-colleague Paula utilized seven different types. Mary, at another campus, utilized twelve categories of materials. Laura, through interview,
added data on six categories. The materials were divided into the following groups: teacher-made curriculum materials, computer assistance, the Young Astronaut Program activities, Civil Air Patrol's Falcon Force materials, rocket building, supplementary reading books, NASA posters, video/film activities, supplementary worksheets, specific display models, newspapers, Weekly Readers, organization newsletters, tape recorded lessons, and other commercially produced materials.

All four subjects utilized materials from the Young Astronaut Program, rocket building, teacher-made curriculum projects, and other commercially produced materials. Norma, Paula, and Mary also used video and film activities.

Computer assistance was utilized by Paula and Laura. Paula and Norma utilized supplementary worksheets, while Norma and Mary made use of the display models. Norma was the only participant to mention using the CAP Falcon Force material. Mary was the only participant to utilize the remaining materials in her classroom.

Because of the method of data collection there may have been more materials which the researcher overlooked.

In which subject areas did these same teachers choose to use aerospace education materials? How were the materials presented to the students?

Six broad subject areas were identified by the researcher. These were: language arts, math, science, social studies, art and physical education. Because of the various categories in the teacher's planbooks and the
differences in grade levels studies, the area of language arts was sub-divided into five separate areas. These were: reading, handwriting, spelling, creative writing and research/report writing.

Norma used aerospace in all the above areas with the exception of social studies and physical education. Paula utilized aerospace in all areas except for handwriting, spelling, and math. Mary indicated use in all subject areas excluding handwriting, spelling, art, and physical education. Laura, during her interviews, indicated usage in all subjects except for handwriting, spelling, math, social studies, art and physical education.

The second part of this research question looked at the means of presentation of these materials to the students. There was an emphasis on hands-on activities by the teachers. The researcher identified nine modes of material presentation through observation and interview. They were: bulletin boards or wall displays; both teacher and student-made, learning centers, cooperative groups, large group lectures, individual student research, model demonstration by the teacher, classroom demonstration by the students, student "hands-on" discovery, and video/film assisted work.

Norma utilized eight modes of presentation, leaving out classroom demonstration by the students. Paula utilized seven types, with the exception of classroom demonstration by the students and model demonstration by the teacher. Mary used each of the modes, with only the exclusion of learning centers. Through interview, Laura contributed information on use in four of the modes; cooperative groups, large group lecture, individual student research, and "hands-on" discovery by the student.
The use of aerospace materials in several different subjects was accomplished by the utilization of a variety of activities. Twenty-one different projects or activities were identified by the researcher.

All four of the subjects used activities from the Young Astronaut Program packets. Norma and Paula used these activities in their classrooms in addition to after school projects conducted in a neighboring district. They had also been requested, by the district, to develop a usage-packet for the district. At this time, Mary was using the Young Astronaut Program exclusively with the students in her classroom. There was no after-school program in her building. Laura had used the materials during the previous three years, but did not have an after-school program for Young Astronauts this year.

Each of the four also used creative story writing, written reports by the students, hot air balloon projects, and rocket launches. Mary, Norma, and Paula identified several more activities. These included: oral reports, query letters, self-portraits as an astronaut, worksheets, space vehicle models, paper airplanes, designing space stations, cloud charts, and solar system models, poetry writing, play presentations, puzzles, timelines, dioramas, space food tasting, and astronomy star parties.

**Did the aerospace education workshop help provide sufficient educational materials for the teacher’s use? What specific agencies provided materials?**

Each of the subjects stated that the workshop did a good job of helping to provide materials to the teachers. They mentioned that having their
names on the initial mailing lists for NASA, the CAP, and the FAA provided many of the contacts which they now utilized.

Thirty-one separate sources for materials were identified by the researcher. Each of the four participants mentioned use of NASA, the CAP, Estes Rockets, Cessna Aircraft, and the Young Astronaut Program as sources of materials for their classrooms. Norma had been in attendance at one of the International Young Astronaut Conventions. Each of the four had also been in attendance at the National Congress on Aviation and Space Education. Paula and Norma attended the first Congress after the workshop, Laura and Mary have been in attendance at every Congress since the workshop.

Paula, Norma, and Laura received information from the FAA. Mary mentioned the Air Force as a large contributor of information, rather than the FAA, when queried concerning significant sources for material acquisition. Paula and Norma also utilized the Space Foundation as a source of information. Paula, Norma, and Mary found General Dynamics, Space Camps (both Alabama and Florida), various bookstores, and private companies not specifically named as additional sources of information.

Mary utilized several sources for materials beyond the other three participants. They included: Texas Association of Aerospace Teachers, Beech Aviation Corporation, Jet Propulsion Laboratories, American Airlines, the Challenger Center, United Parcel Service, airshows, museums, other conventions, Star Trek, various state aeronautics commissions and state departments of education, and the Smithsonian.

In addition to the commercially available materials and resource outlets, each subject also mentioned teacher-made or developed materials as
a source for new information.

What enhancements did the teachers use in conjunction with the aerospace education material?

This material included field trips, speakers, or anything which might not be available through the mail. Many of these enhancements were contingent upon the teacher's contact system outside of the school setting. Nineteen activities were targeted as enhancements to the aerospace materials. All four subjects employed the rocket and hot air balloon launches as additions to their programs. Norma, Paula, and Mary also used video tapes, films, fieldtrips, "hands-on" experiments, and books as extra projects.

Paula and Norma utilized a trip to NASA as an extra project. Paula used the television and on-line computer planning as enhancements to her program. Laura and Mary also utilized the computer but for student instructional purposes. Mary and Norma used guest speakers and various posters with their students. Mary enhanced her program further with the use of the planetarium, visits to an artist/astronaut, presentation of plays by the classroom, airshows, star parties, and a NASA Spacemobile presentation.

This area also utilized parents as "resource people." One of Mary's guest speakers was the "adopted business person" for Building B. This person came as a guest speaker and stayed in monthly contact with the students through letter-writing activities.
What effect had attending an aerospace education workshop had on the teaching practices of the teachers involved?

Each of the participants noted their "hands-on" discovery approach to teaching, particularly in the area of science. Each of the administrators queried also offered this impression of the four participants teaching styles.

The influence of the aerospace workshop on this practice was noted in discussion concerning the practicum experience offered in conjunction with the course. This additional, two week extension to the workshop, provided for an on-site space camp in which the subjects could present information learned during the workshop to groups of elementary children. (This particular practicum experience was no longer a part of the workshop experience.) Each participant noted the excellence of the experience for easing the fear of teaching a new subject to children. They said it proved that the aerospace skills could be taught to elementary students and gave them "hands-on" experimentation with the materials before they actually used them in their own classrooms. Mary and Paula specifically recommended reinstatement of the practicum to the workshop experience.

Direct outcomes of the workshop, as stated by the participants, included: new materials, new sources for materials, specific science instruction tied to other areas of the curriculum, introduction to the Young Astronaut Program materials, inclusion on a mailing list which in turn generated new sources of information, introduction to NASA materials, and available membership in the Civil Air Patrol. This membership in the CAP facilitated the use of airlift with the Air Force, which was the major means of transportation for field trips and conventions associated with aerospace
education. Each participant noted that the field trips, as a part of the workshop, were valuable to the application of information from the workshop. Norma, Paula, and Mary expressed concern that the airlift remain a specific inclusion in the workshop experience.

**What effect did administrators have on the use of aerospace education materials, practices, and perceptions of the teachers being studied?**

The administrators, and teachers alike, felt that inclusion of the Young Astronaut Program materials was a valuable activity associated with aerospace education. Each of the administrators, teachers, and the district science coordinator emphasized that the "hands-on" approach to learning was a significant factor in accomplishment of the stated curriculum goals, and that aerospace education could be a valuable addition to this. However, though several administrators agreed with the teachers when they said aerospace materials could be correlated with the regular curriculum, the administrators were not convinced enough to believe that aerospace education should be used for anything other than an enhancement to the regular curriculum.

Another area of concern centered around documentation activities for use with the essential elements of Texas curriculum. Although the district science coordinator stated that she believed the new textbook adoption proclamation would tend to devoid the essential elements of content-type problems, each of the administrators still voiced their concern over the use of extra materials. The teachers were aware of the documentation, but each stated that with proper knowledge they thought they could cover the
essential elements to the satisfaction of the administration.

Several other areas of concern for the administrators and teachers included: teacher in-service opportunities, financial support from administration, aerospace as a motivator or incentive, parental knowledge and involvement, the importance of new technological issues on current curriculum, and the importance of having the textbooks keep up with the scientific and technological advances.

Demographics:

Each of the subjects possessed a Bachelor's Degree, however, Mary was the only teacher with a degree in science. Laura's degree was in music and the other's degrees were in education. Laura and Paula held Master's Degrees, but neither were in science. Graduate hours of science taken ranged from Mary and Norma's twenty-one hours to Laura's six hours. (Those six hours were the aerospace education workshop.)

Each of the subjects had been actively involved in several in-service opportunities, as a presenter and participant, both within the district and outside the district. The participants had also been involved in writing curriculum for the district at some time.

Conference or convention attendance included international, national, and state meetings by each of the subjects.

All subjects, with the exception of Mary, had gone directly from college into teaching. Mary had work experience outside the teaching field before completing her degree. Each of the participants had taken a sabbatical for the purpose of child-rearing, then returned to teaching.
Paula, Norma, and Laura mentioned specific instances of their families being actively involved in some of the aerospace work within their classrooms. Norma had been exposed to aerospace activities because of her husband's work experience. Mary stated that her children were supportive and that one of her son's knew how to fly.

Conclusions

Use of Aerospace Materials

All the participants were under the impression that the researcher was in the classroom to observe only science activities, yet they informed the researcher, with no prompting on her part, that they were using aerospace education materials in the classrooms. In instances this was done in an apologetic manner, but at the same time they let the researcher know that they intended to use the materials regardless of any outside observations.

Many of the materials employed were purchased by the subjects. Each of them mentioned that the reason they felt NASA, the CAP, the FAA, or the Air Force were so valuable was because the materials were usually free or had only a minimal fee.

Subject Area Usage, Modes of Presentation, and Activities

In interview situations, each of the participants noted that they believed aerospace education could be correlated with every area of the curriculum, not just science. For that reason, the researcher felt that the teachers probably used the materials in each of the subject areas, but
because of the difference of documentation in the planbooks it did not appear that way.

"Hands-on" approaches were very important to the area of presentation. The belief in utilizing this approach was clear for the teachers and the administrators alike. During the interviews with the administrators, each utilized the term "hands-on" when asked to describe or characterize the subjects' teaching styles. As emphasized by the district science coordinator, this approach is receiving a great deal of attention, both during the teaching phase of instruction and the testing phase for evaluation. This also appeared to be the mode that the teachers themselves most enjoyed using to learn new tasks, with the direct use of the approach during the practicum from the aerospace workshop being a prime example. They each stated that they believed the students better understood and retained the information when a "hands-on" approach was utilized. This information supported the earlier work by Shymansky, Kyle, and Alport (1982) concerning the successful use of "hands-on" instruction techniques. The teachers also reaffirmed the belief that "hands-on" experimentation procedures helped make the material more relevant and understandable to the learner (Jones & Piper, 1975).

Materials Provided By The Workshop and Specific Agencies

The response from the participants was solid in affirming the value of the workshop in regard to providing sufficient materials. The most significant acquisition for the teachers involved the addition of their names to the NASA, the CAP, and the FAA mailing lists. These lists then generated several other contacts for the participants.
However, another equally significant acquisition benefited the school system as well. That was the introduction to the Young Astronaut Program materials. The administrators were impressed with the outcomes of the program which included service projects to the school and community and participation in tutoring programs.

The list of twenty-one agencies which the teachers utilized speaks for itself. Each of the participants stated that the more places they found to get materials, the more those generated new sources. The teachers put effort into finding materials that fit their class and curriculum needs. It was evident to the researcher that the attitude of aerospace education being able to cross subject boundaries was exhibited in the number and varied sources for materials.

Curriculum Enhancements for Aerospace Education

Many of the enhancements required real effort on the part of the teachers. The NASA field trip which Norma and Paula spoke about was one which was used as a culminating activity for the magnet math and science program. They had developed a continuum of activities to be used beginning with second grade curriculum and following through the fifth grade setting. Dolezal (1968) stated that the success concerning the use of aerospace education materials had a great deal to do with the dedication and commitment on the part of the teacher.

The participants utilized parents as resource people in this area. They seemed to feel that this personal involvement would help give support to the program. They could tie aerospace education into the "real world" when
exemplified by people the children knew. Many of these enhancements carried the theme of application and reinforcement for the students frame of reference. These films, guest speakers, and field trips were not just 'time-killers' in the teaching day, but were solid ways to reinforce the use of technology and science in the child's everyday world.

**Effects of the Aerospace Workshop on Teaching Practices**

In assessing the effect of the workshop on the teachers, it was interesting to note that this was the first formal introduction to aerospace education for the participants. The researcher believed that these particular teachers would have utilized a "hands-on" approach to teaching with or without the workshop. However, the workshop had a definite influence on how they utilized the discovery approach to science.

The practicum experience influenced each one of the participants. They felt that it enabled them to experiment before they actually faced a classroom of children and had to defend the use of additional curriculum to the administration.

The use of the Young Astronaut Program and the subsequent strong support from the administration is significant. The workshop was instrumental in introducing the teachers to this program, but instituting the program in their schools was purely an individual effort. From the response of the principals and coordinators involved, the program carries benefits beyond the science curriculum.

The benefits of the workshop experience echo the findings of the Tennessee workshop studies by Brewer (1960), Maupin (1975), and Marcum
The recommendations from Miller (1972) and Romero (1973) concerning the relation of aerospace to other areas of the curriculum are also pertinent to this study.

Effect of Administrator's Attitudes on the Use of Aerospace Education

Although the concerns of the principals varied somewhat from the concerns of the teachers, the groups appeared to be mutually supportive in the use of aerospace materials. The teachers believed aerospace could be rationalized in more subject areas than the principals did, but as long as the principals were convinced that the essential elements were being covered, they were supportive.

The teachers' attitudes concerning the district science coordinator were influenced by experiences with the previous coordinator. Previously, they felt they had to spend a great deal of time rationalizing the use of aerospace education materials because the coordinator did not see the benefit of their use at the elementary level. The changes in content for the new science textbook adoption may well strengthen the usage of aerospace education materials in the classroom also.

It was the opinion of the researcher that the pressure felt by the subjects in relation to documentation had little to do specifically with the use of aerospace education materials. The district science coordinator mentioned changes in the essential elements that the principals did not mention. It may well be that these changes have not been passed on to the principals as yet and they are simply acting on prior policy in enforcing documentation.

As expressed by Mary's principal, Mrs. Thayer, it is documentation in
general that is causing feelings of stress. If fact, there seemed to be a great deal of support from the administrators concerning the teachers' utilization of subject matter which could enhance, explain, and apply the geometrically increasing technological advances of our society.

**Demographics**

These four women were far more alike than they were different. Each possessed a high energy level, evident from observation, interview, and investigation of aerospace material usage. In analyzing discussion with each individual, they appeared by be highly divergent thinkers.

The excitement with which each of the participants approached aerospace was immediately obvious to the researcher. Laura was an interesting aspect of this study. Her undergraduate degree was in music education and she had only taken 6 hours of graduate science. Those six hours were participation in the aerospace education workshop. She was extremely frustrated by her present teaching situation and vowed to find a way to introduce aerospace education into her teaching duties. Her attitude perhaps best exemplifies the excitement and commitment which the researcher found among the participants. The teachers exhibited a dedication toward the subject of aerospace education and were going to find ways to use it, no matter what effort they had to expend.

The involvement with in-service activities by all the participants is significant. Their positions have not just been participants, but presenters and individuals involved in writing the curriculum for the district. Participation in these activities and work on these sorts of committees
represents a great deal of time outlay.

The individuals each appeared to have set priorities in their lives, and the impression from discussion was that there was familial support for their choice in spending time on aerospace education projects. There were some instances where family members had attended conferences with the subjects or spent time helping make projects for use in the classrooms.

Recommendations

Recommendations To The Workshop

1. The aerospace education workshops in the state of Texas should definitely be continued.

2. The practicum experience for the participants should be reinstated in order to reinforce the materials and allow for "hands-on" practice by the teachers. The previous teacher was a catalyst in building enthusiasm for the participants, but the participants still needed to experiment with the materials to see how they could best be utilized at the elementary education level.

3. The workshops should retain affiliation with the Civil Air Patrol. The airlift capabilities were overwhelmingly mentioned as benefit of workshop participation. Retention of field trips as a part of the workshop experience is a further recommendation in conjunction with the airlifts.

3. Division of the workshop into sections specifically for elementary teachers and secondary teachers might be more advantageous to acquisition of knowledge and proper utilization of aerospace education materials.
5. The workshop organizers should try to establish a network with school districts in the area which would enable previous participants to communicate with other teachers about the benefits of attending an aerospace education workshop. This could be further expanded to establish a network among previous participants of each summer's workshops to facilitate sharing advances in aerospace education material and additions to the workshop curriculum.

Recommendations to the District:

1. If documentation of the essential elements remains a source of concern within the district, utilize the workshop participants to assist in writing specific curriculum which would conform to district and state guidelines.

2. The district should further utilize workshop participants in the role of in-service presenters.

3. The administration might discuss some means of providing partial financial support or partial tuition for conference attendance or workshop participation. Most of the previous support had been mentioned through the gifted education office. There may be regular classroom teachers in need of support.

Recommendations to the Participants:

1. The previous participants should consider establishing a personal communication network. There may be teachers within the district with the interest in aerospace education who have not attended a workshop.
2. The previous participants should establish a data bank of aerospace information and sources for materials which might be accessed by other teachers in the district.

Recommendations For Future Research:

1. The workshop should consider undertaking research to evaluate the use of aerospace education materials by secondary participants of the previous workshops.

2. Continued research should be considered to evaluate the personality types of teachers participating in the workshops. The four subjects of this study proved to be similar in nature and outlook, but expansion of the research, in a larger population base, should be considered.
APPENDICES
APPENDIX A

AVIATION/AEROSPACE AGENCY GOALS
AGENCY GOALS

Federal Aviation Administration

The goal of the Federal Aviation Administration Education program is to:

1. Make use of tested aviation education techniques in working with students, educators, representatives of local, state, and federal government agencies as well as appropriate industries, organizations, and members of the public.
2. Involve FAA employees as resource persons in sharing their expertise with those who will use it in planning and carrying out aviation education programs, projects, and activities.
3. Ensure that FAA's mission attainment makes the fullest possible use of existing resources both within and outside the agency.

The structure of the FAA is such that it utilizes a regional approach to organization. The roles, responsibilities, and relationships between FAA Headquarters, Regions, and Local Facilitators are described in the following.

Headquarters

The Office of Public Affairs:

1. Provides overall policy and professional aviation education guidance.
2. Evaluates and develops aviation education materials for distribution.
3. Provides a system of aviation education data collection and
dissemination.

4. Encourages and maintains cooperative relationships with key groups and individuals including federal, state, and local government officials and agencies, industry, public and private schools, colleges and universities, and education-related organizations including professional, social, service, and civic organizations with mutual interests in aviation education.

5. Develops information services support for special projects such as topical writing contests, aviation-related design competitions, and formulation of educational strategies including aviation software program design for use with home and school computers.

6. Develops and maintains an appropriate recognition program for both FAA personnel and others participating in the aviation education program.

7. Evaluates the aviation education program on a continuing basis by analysis of field reporters.

Regions

The Regional Aviation Education Coordinator:

1. Provides regional aviation education program direction and coordination.

2. In accordance with regional needs, identifies, and communicates with the appropriate federal, state, and local agencies as well as individuals and representatives of industry, education, and organizations involved in aviation education.
3. Develops local aviation education resources within FAA and the private sector.

4. Develops and maintains a regional aviation education resource center that includes the variety of aviation education materials available from FAA, other government agencies, and from industry and other organizations.

5. Reports aviation education program activities through the Regional Director to the Assistant Administrator for Public Affairs.

6. Evaluates the aviation education program on a continuing basis by analysis of field reports.

Field Facilities

Local Aviation Education Facilitators:

1. Plan and coordinate tours of FAA facilities for educational groups.

2. Coordinate access to FAA technical resource personnel by educators and others interested in aviation education.

3. Identify FAA, industry, and local organizations and individuals who can provide aviation education resources.

4. Communicate with school and college staff and teachers and coordinate the use of aviation education resources in their programs.

5. Represent the FAA at appropriate meetings and conferences in the local area.

6. Report aviation education program activities through the Facility Manager to the Regional Aviation Education Coordinator.
7. Evaluate the aviation education program on a continuing basis.

(Strickler, 1983 p. 1, 10-12.)

The Civil Air Patrol

The Civil Air Patrol, an organization headquartered at Maxwell Air Force Base in Alabama, is another contributor to the aerospace education arena. The basic objectives of the Civil Air Patrol's aerospace education program are to demonstrate the following:

1. A reading or speaking vocabulary of aerospace terms.
2. A knowledge of weather and climate as factors in aerospace operations.
3. A knowledge of the physical and biological science as applied in aerospace explorations.
4. A general understanding of the structure of aircraft, rockets, missiles, satellites, and space vehicles.
5. A familiarization with the aerospace industries.
6. An understanding of the social, economic, and political implications of aerospace technology.
7. A knowledge of airports, airport service, and the functions of airport personnel.
8. An understanding of existing and proposed government services and regulations that facilitate aerospace operations.
9. A knowledge of the materials, personnel, and equipment available as resources for aerospace education programs.
10. An understanding of the political, economic, social, and educational problems created by aerospace technology.

11. A realization that aerospace vehicles have changed traditional concepts of land masses, water barriers, speed, time, and distance.

12. A knowledge of career opportunities in science, engineering, and other fields that result from aerospace vehicle development, manufacture, and operation.

13. A knowledge of the impact of aerospace progress on international relationships.

14. An understanding of the basic scientific and engineering principles inherent in air and space vehicle development, manufacture, and operation. (Strickler, 1968, p. 315-316)

National Aeronautics and Space Administration

A NASA Fact Sheet (1983) lists involvement concerning the following educational services:

1. Assisting state departments of education, school districts, professional education associations, and institutions of higher education with aerospace-related courses.

2. Conducting conferences for educators in conjunction with special events such as launches and planetary encounters.

3. Developing educational publications such as curriculum supplements, single resource units, informational booklets about specific NASA projects, and reprints from professional journals.
4. Conducting programs for both the academically talented and the culturally deprived which offer opportunities for youths to become involved in a variety of aerospace activities at both school and the Centers.

5. Providing the services of aerospace specialists to local schools to present assembly programs and to work in classrooms with teachers and pupils using simple experiments and scale models of space hardware to explain the basic scientific principles applied to the exploration of air and space.

6. Providing the services of the Aeronauticsmobile which visits schools and discusses NASA research and development in the field of aeronautics.

7. Providing speakers that are knowledgeable about NASA's activities to civic clubs and other professional organizations.

8. Providing audiovisual consultants to assist in the programming of materials for radio and television.

9. Providing NASA materials to support programs operated by planetaria, museums, and science centers.
APPENDIX B
AEROSPACE WORKSHOP SYLLABUS
Air and Space Science for Teachers

Basic Course Outline: This class was offered for three hours of Natural Science credit at the Graduate level. Ten class meetings, constituting a two week workshop period, were held from 8:00 a.m. to 4:00 p.m. daily.

In addition to daily lectures dealing with the science of flight the following activities were presented:

1. Field trip to Dallas/Ft. Worth Air Traffic Control Tower
2. Field trip to Ft. Worth Air Traffic Control Center
3. Field trip to American Airlines
4. Evening Rocket Launch; rockets constructed by the class
5. Delta Dart Activity
6. 85% of the class participated in an airlift to the Smithsonian Air and Space Museum in Washington, D.C.

The following films were utilized for instruction:

1. Air and Space Museum: A Place of Dreams
2. Aeronautical Antics
3. Basic Radio Procedures for Pilots
4. To Fly
5. Unchained Goddess (Meteorology film)

Practicum Experience: An additional three credit hours were offered for participation in a Space Camp practicum. The teachers involved planned and executed various activities with youngsters, grades second through eighth, during a two week period. These activities included information and materials introduced during the first two weeks of the workshop experience.
APPENDIX C
TEXAS STATE TEXTBOOK PROCLAMATION, 1989
AND
OUTLINES OF TEXTBOOKS UTILIZED BY
STUDY PARTICIPANTS
A listing of content, pertinent to aerospace, to be included in 1989 textbook adoption guidelines for the state of Texas in the area of earth science.

Content from earth science shall be introduced in Grade 1, presented at each grade in a developmentally appropriate sequence through Grade 6, emphasized in Grades 2 and 5, and shall include:

[Sections 1, 2, and 3, omitted]

4. astronomy
   - description of solar system including physical characteristics and motion of the sun, planets, moons, asteroids, meteoroids, and comets
   - radiation from the sun
   - earth/sky motions including causes of day and night, seasons, apparent motions of the celestial sphere
   - interactions of earth/moon/sun
   - description of the universe including physical characteristics of galaxies, quasars, and nebulae
   - physical characteristics and life cycles of stars

5. space science: travel, time, distance in space, technology used in space

6. meteorology
   - description of the atmosphere
   - causes and effects of weather change and severe weather types
   - air masses and types of weather fronts
   - description and formation of cloud types
   - water cycle and types of precipitation
   - weather maps and instruments used to measure temperature, atmospheric pressure, relative humidity, wind speed, etc.

7. land, air, water, and space: exploration activities and trends in the past, present, and future

8. application of earth science to careers and everyday life

9. human responsibility regarding earth science phenomena: science, technology, and society; land, air, water, and space ethics; natural resources; conservation; etc. (Texas Education Agency, 1989)
UNIT 1
Chpt. 1 Animals are Different
1. Mammals
2. Birds
3. Fish
4. People and Science
5. Chpt. Review

Chpt. 2 More Animal Groups
1. Reptiles
2. Amphibians
3. Insects
4. Animals of Long Ago
5. People and Science
6. Chpt. Review

UNIT 2
Chpt. 3 Weather
1. What Makes Weather?
2. Hot and Cold
3. Weather Changes
4. People and Science
5. Chpt. Review

Chpt. 4 Water in the Air
1. What is Air?
2. Where Does Water Go?
3. Where Does Water Come From?
4. Clouds
5. People and Science
6. Chpt. Review

UNIT 3
Chpt. 5 Sound
1. What is Sound?
2. Sound Are Different
3. Sound Makers
4. Sounds Move
5. People and Science
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