THE EFFECTIVENESS OF NATIONAL AERONAUTICS AND SPACE ADMINISTRATION EDUCATIONAL SATELLITE TELECONFERENCES FOR TEACHER TRAINING

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CHAPTER I

INTRODUCTION

The Nature of the Problem

The National Aeronautics and Space Administration (NASA) is a world leader in the development of communication satellites. With the 1974 launch of the Application Technology Satellite 6 (ATS-6), NASA pioneered the use of satellites for educational teleconferences (NASA, 1983, p. 39). ATS-6 was the first communication satellite with sufficient power to relay television signals to small local receivers and was used extensively in demonstration projects for educational and public health programs in rural areas of the United States and India.

Today, educational satellite teleconferences are widely employed at all levels and disciplines of the educational community by public, private, and commercial agencies. NASA continues to make use of communication satellites to further its educational objectives for staff development of professional educators. These objectives are an extension of the mandate given to NASA through its creation by the Space Act of 1958. The act requires NASA to contribute materially in the "...expansion of human knowledge of phenomena in the atmosphere and space" and to develop the technologies necessary to achieve this objective (U.S. Congress, 1978,

p. 1). The Space Act of 1958 further requires the administrators of NASA to "...provide for the widest practicable and appropriate dissemination of information concerning its activities and the results therof" (U.S. Congress, 1978, p. 5). In partial response to these provisions, NASA established an educational affairs division to coordinate all educational efforts of the agency.

Throughout its 30 year history, NASA has conducted extensive and wide reaching educational programs including sending professional educational specialists to make presentations in schools, hosting teacher pre-service and in-service workshops, mounting exhibits, supporting curriculum materials development, and conducting various forms of teleconferencing. In just the field of teacher training for the 1987-1988 school year, NASA presented face-to-face teacher workshops to more than 27,000 pre-service and in-service teachers (Aerospace Education Services Program, 1988, p. 3).

In 1987, NASA's Educational Affairs Division adopted a five-year plan to direct its efforts during fiscal years 1988 through 1992.

> The major purpose of the Educational Affairs Division Five-Year Plan is to guide the use of our NASA resources in administering a focused and consistent set of aeronautics and space science education programs. The ultimate goal is to directly and indirectly help to ensure an adequate pool of talented scientists, engineers, and technical personnel to keep NASA at the forefront of advancements in aeronautics, space science, and exploration for the 21st century (NASA, 1987, p. 3).

The five-year plan identifies teacher education as a major area of emphasis. It directs NASA educational programs to assist,

whenever possible, in the preparation of new teachers of science and mathematics, aid in the continuous professional development of in-service teachers, and "supplement the content of existing science and mathematics methods courses, as well as other subject matter and methods courses" (NASA, 1987, p. 7) In partial fulfillment of these aims, NASA's Educational Technology Branch hosts a regular series of four, one to one and a half hour-long educational satellite teleconferences ("videoconferences") each school year.

William Nixon, Head of NASA's Educational Technology Branch which coordinates educational satellite teleconferences, states that NASA has recognized teleconferencing as a way of reaching large numbers of teachers at one time. "NASA Educational Affairs has found interactive satellite videoconferencing to be effective in communicating with large numbers of teachers and plans to continue to expand and improve them" (Nixon, 1989, p. 7).

> The reason that we started videoconferences is that we were looking for ways to increase our delivery to teachers. We decided to try to present the things that we do in our workshops and on our visits to schools and universities on satellite videoconferences. Consequently, we have proven that satellite videoconferencing can increase our delivery system to teachers. Just how effective this approach is, compared to face-to-face presentations, I can only guess because we have not had our videoconferences evaluated as of yet (Nixon, 1988, p. 1).

NASA's position that teleconferencing can increase their delivery to teachers is supported by a comparison of teacher participant numbers serviced through NASA's traditional face-to-face teacher workshops with the number of teacher participants served

through educational satellite teleconferences. During the 1987-88 school year, NASA aerospace educational specialists, working through NASA's Aerospace Education Services Project, presented 1,639 face-to-face teacher workshops to a total of 27,707 teachers. These workshops generally ranged in length from an hour or two to several days (Aerospace Education Services Program, 1988, p. 3). During the fourth and final NASA educational satellite teleconference in the series for that same year, it was estimated that 8,800 teachers participated in the teleconference as it was being aired while an additional 13,000 teachers would see the teleconference on tape at a later date (Phelps, 1988, p. 2). In other words, a single educational satellite teleconference compiled an estimated audience total nearly equal to 80 per cent of the cumulative audience encountered through several thousands of hours of face-to-face workshops.

Statement of the Problem

Judging only from the numbers of teachers encountered, NASA educational satellite teleconferences appear to be an effective delivery method for teacher training. However, comparing participant numbers does not speak to the actual benefits accrued through educational satellite teleconferences. Do educational satellite teleconferences provide information and experiences to teacher participants that will be used by those teachers in their classrooms? What it needed is an objective look at what NASA educational satellite teleconferences actually accomplish in the area of teacher training.

Purpose Of The Research

Although many short-term studies of teleconference effectiveness in a variety of applications exist, comparatively few studies have attempted to assess long-term effects on participants and fewer still have attempted to assess teacher use of teleconference content with the students they teach following their voluntary participation in educational satellite teleconferences. Typically, assessments are made immediately after teleconferences when the participants have not had time to assimilate the information they received. Their responses are based on what uses they perceived they might find for the information received. However, because viewers of many staff development teleconferences attend voluntarily, they are not obligated to use the information presented and whether or not that information is actually used is open to question. This observation leads to the main purpose for this study. The purpose of this study is to determine if teachers voluntarily attending NASA educational satellite teleconferences consider them to be effective and if they make use of the information presented in those teleconferences with the students in the classes that they teach? Secondly, the study is aimed at determining if a statistically significant relationship exists between teacher opinions on the relevancy, effectiveness, and usefulness of the teleconference, as reported in a post-teleconference survey, and their actual use of program content in their classroom. Third, the study will attempt to find ways of improving NASA educational satellite teleconferences by surveying participating teacher opinions.

These questions will be addressed through research hypotheses and research questions.

Statement of the Hypotheses

The hypotheses to be tested in the null will be the following:

Research Hypothesis One

There is no significant relationship between teacher responses on the relevancy of program content item in the post-NASA educational satellite teleconference rating survey instrument and their actual subsequent classroom use of that program content.

Research Hypothesis Two

There is no significant relationship between teacher responses on the effectiveness of program content item in the post-NASA educational satellite teleconference rating survey instrument and their actual subsequent classroom use of that program content.

Research Hypothesis Three

There is no significant relationship between teacher responses on the prediction of future use of program content item in the post-NASA educational satellite teleconference rating survey instrument and their actual subsequent classroom use of that program content.

Statement of the Research Questions

In addition to the research hypotheses, other valuable information will be obtained through the survey and the follow-up telephone contacts. Information will be sought on whether or not teachers have actually made use of teleconference content with the students they teach. Also sought will be teacher opinions regarding the value of the five different components NASA teleconferences are divided into. These include:

1. information on current NASA projects (e.g., Aeronautics, Living In Space),
2. educational activities for the classroom,
3. announcements of NASA educational products and services,
4. ability to interact with the presenters (e.g., question & answer), and
5. receipt of NASA educational materials after the conference (e.g., publications).

Finally, teacher opinions on how to improve future teleconferences will be requested and a comparison will be made of the accuracy of pre-teleconference teacher attendance estimates by site coordinators to actual teacher attendance. This information will be gathered to answer the following research questions:

Research Question One

Do teachers make use of the content of NASA educational satellite teleconferences with the students in the classes that they teach?

Research Question Two

How do teachers, participating live in NASA educational satellite teleconferences, rank each of its five components presented in terms of relative importance?

Research Question Three

In the opinions of teachers, participating live in NASA educational satellite teleconferences, how can future teleconferences be improved?

Research Question Four

How do pre-teleconference registration estimates of teachers to be in attendance for NASA educational satellite teleconferences compare to actual attendance totals?

Definition of Terms

The following terms will be used in this study:

Educational Satellite Teleconference - A teleconference designed specifically for educational purposes and that makes use of one or more Earth orbiting satellites as communication links, usually for video and audio signals.

Interactive - An opportunity for teleconference participants to communicate directly with teleconference presenters during the teleconference.

Site - A remote teleconference viewing location.

Site Coordinator - The person responsible for arranging for reception of the teleconference signal, advertising the teleconference to colleagues, arranging for the teleconference viewing room and needed television and telephone equipment, and the distribution of printed teleconference materials such as curriculum guides and survey instruments.

Teleconference - A conference between two or more groups of people or three or more persons in different locations via one or more forms of electronic media including radio, telephone, television, and computer networks.

Videoconference - A term denoting a specialized form of teleconference that makes use of television transmissions as the primary communication medium.

Limitations of the Study

The design of this study is limited by several factors. The National Aeronautics and Space Administration offers its educational satellite videoconferences to any school that has suitable satellite receiving equipment to receive it. Videoconference announcements are sent out prior to the start of each school year's series. Schools and other educational institutions are asked to register for the series and upon doing so, receive educational materials specific to each program. As a part of this registration, site coordinators are asked to estimate the number of teachers who will be in attendance to see the teleconferences live and the number who will see the teleconference at a later time on tape. While NASA's educational satellite teleconferences are directed towards enhancing teacher understanding of NASA activities and program results and towards providing specific ideas for classroom applications, the nature of the audience permitted to see these teleconferences at each receiving site is a local decision. The teleconferences are held from 1:30 to 2:30 or to 3:00 p.m. Eastern Standard Time. This means for most of the nation, the teleconferences are held during regular school hours. Sites may permit students as well as teachers to watch the programs thereby diminishing somewhat the intended speaker-to-teacher intimacy that would likely occur in an audience of teachers only.

Because of the voluntary nature of attendance at NASA educational satellite videoconferences, those teachers who do attend are likely to have a strong interest in NASA's activities and to be motivated towards making use of program content. Consequently, data collected following the teleconference and used for this study may be favorably biased.

This study relies heavily on the voluntary participation of teachers in completing the post-teleconference survey instrument and their willingness to be contacted by telephone at a later date for additional information. Teachers who volunteer to complete the survey instrument as well as granting permission for a telephone interview may not be representative of the entire population of teachers watching the teleconference. It is possible teachers not wishing to be interviewed by telephone will be more negative than teachers willing to be interviewed, therefore positively skewing the statistical results.

Finally, this study relies on registration forms, completed by site coordinators, for an estimate of the total teacher audience that will be in attendance at the particular educational satellite teleconference chosen for this study. A more reliable estimate of the total number of teachers in attendance at the viewing sites participating in the study will not be available until survey forms are returned.

Assumptions of the Study

This study makes a number of assumptions. The specific educational satellite teleconference chosen for this study, *Future Explorations* (January 21, 1989), is assumed to be representative of the four educational satellite teleconferences held by NASA's Educational Affairs Division during the 1988-89 school year. The post-teleconference opinion survey form employed in this study and the follow-up telephone interview format are assumed to be valid and unbiased measures of the opinions of the teachers who participated in the educational satellite videoconference. It is finally assumed that the teleconference viewing sites selected for the study, those in which site coordinators estimated during preregistration that ten or more teachers would be in attendance, offer a reasonable comparison to traditional face-to-face teacher workshops which typically serve groups of teachers.

Summary and Organization of the Study

Chapter I detailed the nature and statement of the problem, the need for the study, statement of the hypotheses and research questions, definitions of terms, and outlined the assumptions and limitations of the study. Chapter II will set the foundation of the study through a review of the relevant literature on teleconferences with an emphasis on educational teleconferences. Chapter III relates the methodology and design of the study. Chapter IV presents the analyses of the data collected for the study and Chapter V presents

the summary of the study, findings, conclusions, and recommendations.

CHAPTER II

REVIEW OF THE LITERATURE

Definitions

Due to the variety of contexts in which the word teleconferencing is employed, it is important to define what teleconferencing is.

> The term "teleconferencing" refers to two-way electronic communications between two or more groups, or three or more individuals, who are in separate locations. In order to interconnect people, teleconferencing systems use telecommunications channels that range from regular telephone lines to satellite links. The only requirement is that the medium be interactive, giving people at each location the opportunity to actively participate in the meeting (Olgren and Parker, 1983, p. 1).

Olgren and Parker identify four distinct kinds of teleconferencing including audio, audiographics, video, and computer conferencing. Though organizationally and technologically different, each share several characteristics:

1. They use some kind of telecommunication channel and technology;
2. They link individuals or groups of people at multiple locations;
3. They are interactive, providing two-way communication and
4. They are dynamic and live, involving active participation of people" (Olgren and Parker, 1983, p. 7).

Falling into Olgren and Parker's definition are teleconferences that employ telephone, radio, computer electronic mail, electronic blackboards, various forms of television transmissions, artificial Earth satellites, and any combination of the above as the medium of communication.

Olgren and Parker point out that "...educators were the first group to adopt and apply teleconferencing systems, primarily to extend educational opportunities to people in distant locations." They also stated that "teleconferencing has been applied to continuing professional education, college credit instruction, general adult education, in-service programs" (Olgren and Parker, 1983, p. 15).

Teleconferencing as well as *ad hoc* teleconferencing has also been defined:

> Teleconferencing means conferring at a distance or holding a long-distance conference. The conference participants are geographically separated, and they 'meet' with the aid of technical media that transmit their voices and/or images. Teleconferencing allows several persons to participate in meetings without the necessity of face-to-face contact. Participants can be geographically dispersed and still 'meet,' using the technology as the means that brings them together (Kelleher and Cross, 1985, p. 1).

Kelleher and Cross define *ad hoc* teleconferencing as "...a special, one-time event that an organization chooses to broadcast" (Kelleher and Cross, 1985, p. 216). The NASA educational satellite teleconference series for teacher training function as *ad hoc* teleconferences because each program in the series is independent of the others and is able to stand by itself.

To summarize the above descriptions, a teleconference is an electronically based interactive meeting held between participants in multiple locations that are separated far enough from each other to make face-to-face contact difficult if not impossible. The specific variety of teleconference that will be examined in this paper is the educational satellite teleconference. An educational satellite teleconference is one that uses radio technology to relay communications through one or more Earth-orbiting satellites to link together widely separated participants with video and audio signals. Because of the high cost of television studios, satellite uplink equipment, and federal communication licensing, most educational satellite teleconferences restrict the communication link to feature one-way video and two-way audio transmissions. Featured presentations originate at a television studio and the resulting video and audio signals are uplinked to a satellite for relay to low-cost satellite receiving dishes at remote sites. Audio interaction with the remote sites is usually accomplished through normal telephone communications.

Potential Uses of Teleconferencing

The literature of teleconferencing is replete with descriptive studies describing the potential for teleconference uses. Azarmasa has identified a number of applications for teleconferences but saw fit to caution that "...one very important point must be remembered: teleconferencing is not intended to replace the classroom teacher but,

rather to extend the classroom beyond its immediate walls" (Azarmasa, 1987, p. 32).

Azarmasa compiled the following list of educational applications of teleconferences:

> Teaching subjects and new technology;
> Teaching in large geographic area where standard instruction is crucial;
> Teaching large numbers of students where demonstrations are critical;
> Teaching where well-prepared presentation is important;
> Teaching foreign language when telephone lines are available;
> Teaching subjects simultaneously at several different campuses;
> Teaching adult education where attendance is a problem;
> Seeking expert opinions when experts not physically nearby;
> Watching special academic events and
> Hearing keynote speakers when it is not possible to attend (Azarmasa, 1987, p. 31).

Azarmasa has also identified several applications of teleconferencing specific to staff development:

> Routine in-service training;
> Updating information - immediacy and timeliness of information;
> Inexpensive training for large groups;
> Renewing credentials;
> Multi-connections between different sites for interaction;
> Flexible hours;
> Watching different models of teaching at different sites;
> Electronic visitation of facilities and
> Electronic class reunion (Azarmasa, 1987, p. 31-32).

Like Azarmasa, other proponents of satellite teleconferencing claim satellite teleconferences to be an effective means for professional development.

> In my own experience, teleconference courses can provide useful information and techniques that teachers will accept and use, provided that we perfect the mechanical aspects of the system, use local coordinators to encourage the widest participation possible, and schedule occasional face-to-face visits by the instructor. If we create a sense of community while providing information, teleconferences will prove to be an effective mode of instruction" (Hagstrom, 1983, p. 46).

O'Bryan supports Hagstrom's provisos though O'Bryan was speaking specifically of instructional television for children.

> The odds from the research on ITV instructional television in the elementary school are overwhelmingly supportive for a belief that the medium cannot replace the teacher; is dependent for ultimate success on intelligent interaction and mediation by a skilled, live professional; and perhaps most strongly of all, can do an exceptional job of motivating and instructing children in almost any area of education from basic skills to fine arts (O'Bryan 1980, p. 22).

Penrose identified several situations during which teleconferencing should be employed:

1. Meetings that involve people who know each other and who are low in conflict.
2. Meeting with people with poor verbal skills.
3. Cooperative problem (Penrose, 1984, p. 101).

Advantages of Teleconferencing

Many studies, including Cowan, Henrie and Whiteford, and Keiper point out numerous advantages of teleconferences over the traditional fact-to-face meeting. Cowan states that teleconferences reduce travel time, make better use of staff and executive time, provide broader access to resources, increase communication

frequency, and reach many people at the same time with a single message (Cowan, 1984, p. 6). Henrie and Whiteford found positive student reaction to telephone teleconferences as an alternative to face-to-face supervision of home economics teachers (Henrie and Whiteford, 1972, p. 1). Keiper studied business use of teleconferences and found that business professionals report better quality and faster decisions than those arrived at during face-to-face meetings (Kieper, 1984, p. 106). Cowan cited an earlier Booze and Allen study which surveyed perception of effectiveness of business teleconference users who employed teleconferences at least 20 times a month. The study found the following:

1. 90% very satisfied with teleconference use.
2. 75% perceived an increase in productivity.
3. 75% reported a decrease in travel expense.
4. 75% experienced less time away from home offices.
5. 50% reported increase in meeting efficiency.
6. 50% perceived decrease in time to reach decisions.
7. 50% noted increase amounts of communications.
8. 33% reported an improvement in decision quality (Cowan, 1984, p. 9).

An Office of Technological Assessment report on distance learning for the U.S. Congress describes numerous advantages and future impact of distance learning techniques that include teleconferencing as a principle communication mode.

> While reaching a small number of teachers today, distance learning will greatly affect the teaching force of tomorrow. Distance learning provides not only a variety of tools for teaching, but also a means to upgrade teacher's skills and encourage their professional development. Teachers can team teach with their colleagues across town or across the country, discuss problems and challenges over electronic networks,

> observe master teachers in action, participate in professional meetings and courses, develop new skills, and earn advanced degrees--all without leaving their home school. Teachers must have training, preparation and institutional support to successfully teach with distance learning technologies, as indeed they must for all of today's educational technologies. Also, their concerns about technology and the quality of instruction must be taken into consideration in planning distance learning efforts. Teacher input not only shapes development, it assures long-term commitment (U.S. Congress, 1989, p. 1).

Teleconferencing Effectiveness

Bjorklund and Fredmeyer, in examining the potential advantages of teleconferencing over face-to-face communications have stated that "the cost of travel, meals, and lodging versus telephone calls is the most obvious place to think of savings. However, a frequently overlooked cost savings is the unproductive travel time avoided by teleconferencing" (Bjorklund and Fredmeyer, 1985, p. 23). Nordwall echoed Bjorklund and Fredmeyer. "The biggest advantage of videoconferencing to Boeing is the saved travel time, primarily for engineers. The savings in travel expenses, are a significant secondary factor" (Nordwall, 1990, p. 53). In speaking of live television, Hudspeth and Brey stated "Live television is especially useful because it avoids the usual time delay, up to three years, between the conception and delivery of a prerecorded course of study" (Hudspeth and Brey 1986, p. 24). Immediacy of information transfer is often cited by satellite teleconference proponents.

O'Bryan, again speaking of educational television research stated:

> Almost all the research I have reviewed found that the programs studied achieved some part, but rarely all, of their educational objectives, except when they were used by high-quality, well briefed teachers. Then the results were much more impressive, often out-performing the textbook and other aids used in teaching (O'Bryan, 1980, p. 24).

Of vital importance to the consideration of teleconferencing to professional development activities is user acceptance of the medium. Positive reactions to teleconferencing by users has been found to be strong in many studies that have sought to compare teleconference effectiveness to more traditional forms of classroom instruction and meetings. Schramm conducted a study related to teleconferencing by reviewing some 400 published studies on television teaching. Though not strictly considered teleconferencing, because of the lack of two-way communication, the technology for television teaching is similar to that of teleconferencing because through it teachers and students are linked electronically. Schramm summarized his findings and stated that:

> .... when the usual tests of achievement used by schools to measure student progress are employed, it may be said with considerable confidence that in 65 percent of a very large number of comparisons between televised and classroom teaching there is no significant difference (Schram 1962, p. 158).

Schramm concluded "a striking fact has been presented here---the fact that about as much learning seems to take place in a TV class as in an ordinary class" (Schram 1962, p. 164).

In a comparison of television instruction versus conventional classroom, Blumberg found no significant difference in the outcomes for an elementary statistics class for low ability students. However, contrary to Schramm's conclusion, medium and high ability students that received conventional instruction scored significantly higher on an achievement test than those who received television instruction (Blumberg 1978, p. 21

McConnell presented the major outcomes of a 2 year trial of Great Britain's Open University experiment with the Cyclops shared screen telewriting tutoring system. Participating students, in remote locations, were able to converse with the instructor and other students by use of telephone and were able to share diagrams with a digitizing pen and television screen. McConnell concluded "Cyclops can be as effective as face-to-face tutorials" (McConnell 1986, p. 65). McConnell noted that user satisfaction with the system was not as high when compared with face-to-face tutorials because of the lack of closeness. "This causes participants to view the effectiveness of the medium negatively even though many tutorial tasks are accomplished via the medium" (McConnell 1986, p. 65).

An experimental study conducted by Davis sought to compare attitudes and achievement for students exposed to teleconferences, face-to-face training, and a combination of the two, Davis confirmed previous studies that there was no significant achievement differences resulting from different treatments between the experimental groups. Davis did note that all face-to-face instruction generated a much more positive participant attitude than the treatments did for the participants in the other groups. However,

Davis found no significant relationship between attitude toward teleconferences and learning outcome. (Davis 1984, p94-97)

Jacobs and Bollenbacher, sought to explore the relationship between student ability level and television instruction. They found that the results of their experiment "...do not consistently favor one group since the TV groups are seen to exceed the non-TV groups at the 'high' level. At the 'middle' ability level, there is little difference between the two averages" (Jacobs and Bollenbacher 1959, p. 185). They did discern a reversal of performance in the low ability group where the non-TV students performed better than the TV students.

> The significant interaction indicates that the methods produce differential results depending upon the levels at which they are used. It is obvious, therefore, that a general statement for all ability levels regarding which method is to be recommended cannot be made (Jacobs and Bollenbacher 1959, p. 189).

In an examination of telephone-based teleconferencing, Rushton asked "Do students receiving instruction through remote delivery perform complex skills at an equal or higher level than counterparts taught through conventional instruction?" (Rushton 1981, p. 18). Rushton's research concluded that scores computed following the administration of terminal learning objectives tests "...showed no statistically significant difference between scores of subjects receiving instruction through teleconferencing and those to whom conventional instruction was administered (Rushton 1981, p. 25).

Equally consistent results were cited by Weingand. Weingand compared traditional classroom instruction with telephone instruction for library science and questioned a common assumption.

> It is a popularly held assumption--particularly in higher education--that learning which occurs within a classroom setting, face-to-face contact between student and instructor, is superior to other possible educational models (Weingand, 1984, p. 269).

Weingand's study reached three conclusions concerning the effectiveness of teleconferences for education:

1. There is no evidence to support the popular belief that the classroom is assumed to provide the optimum model for delivery of education.

2. Telecommunications delivery of an educational experience can facilitate learning in equal or better measure than classroom instruction.

3. The absence of face-to-face interaction and the substitution of teleconferencing interaction is not detrimental to the learning process (Weingand, 1984, p. 273).

Kuramoto experimented with the use of telephone teleconferences for continuing education of nurses with the intention of evaluating learner performance and attitudes toward delivery method. Kuramoto questioned participants about their intended uses of the content of the continuing education programs and found no significant difference in intended use of the content between the students who received telephone only instruction versus those who received more conventional treatments (Kuramoto 1984, p. 267). Kuramoto did attempt to conduct a follow-up survey six months later

to assess actual use of the content but participant response was insufficient to produce meaningful data (Kuramoto 1984, p. 267).

Though generally very positive about the benefits of teleconferences, other researchers, like Davis have expressed caution regarding results. They see a temptation to equate user satisfaction with results. Parker and Monson point this out by citing a 1973 study by Casey-Stahmer and Havron. The earlier research "...developed valuable guidelines for evaluating any teleconferencing system. They contend that a distinction should be made between user satisfaction and the overall effectiveness of the system" (Parker and Monson 1980, p. 47).

The experience of Brown, Brown, and Danielson also points to the question of user satisfaction versus overall effectiveness of the medium. In a study of instructional television treatments on adults they found that the production values of the program affected attitudinal reactions of the viewers and their achievement.

> The results suggest that the varieties of presenters in televised instructional segments were not only responded to differently in terms of attitudinal reactions of the learner but also that achievement in one instance at least was significantly related to characteristics of the talent...that adult learners are responsive to an enthusiastic portrayal. The presenters must appear to be intrinsically interested in the subject matter themselves and eager to share the knowledge with the viewer. A bland presentation or one marked by apparent confusion yields negative attitudinal responses and can effect achievement....It is possible from these results to conclude that a presenter can be too attractive; the viewer's attention can be drawn more to the presenter than to the nature of the presentation (Brown, Brown, and Danielson, 1975, p. 401).

A study, by Mitroff and Eichelberger on the Pennsylvania Department of Education's teleconferences held to explain its School Improvement Plan actually detected some diminished interest in the plan following two state-wide teleconferences. Pre- and post-teleconference questionnaires examined demographics and the qualitative impact of the teleconference experience on the participants. Results ranged from neutral to positive (Mitroff and Eichelberger, 1983, p. 277).

In spite of the diminished interest in the Pennsylvania plan by some of the respondents, Mitroff and Eichelberger stressed the value of teleconferences to staff development programs.

> Television technology is a potent vehicle for information/linkage during the critical initial stage of any change effort. The power of television can be used to mobilize and energize a target audience around the goals of the change effort. The use of television technology can help to provide a 'common language' with which the educational community can communicate about the effort. The use of television can provide a set of 'shared images' on the meaning of particular change efforts. And the use of television can, because of its pervasiveness in society, facilitate reaching a broad range of stakeholders (Mitroff and Eichelberger, 1983, p. 274).

A number of investigators have expressed interest in evaluating the use of teleconferences for staff development and the pre-service training of teachers because of the obvious advantage of reducing travel. An experiment in delivering pre- and in-service mathematics courses via telephone to small numbers of teachers across Montana was reported by Davidson. The courses were begun

in person and then continued by telephone. Though accomplishing its educational aims, the students pointed out a number of problems.

> In evaluating the ETS system, the advantages mentioned above (receiving instruction in remote areas) are offset by a number of weaknesses identified by the students. The most serious of these is the lack of personal contact, the need to be able to see the instructor and students at other locations" (Davidson 1980, p. 24).

Interaction, or lack of it, among participants is a consistent theme in teleconferencing evaluations. Pardoe described an Australian experience in teleconferencing "...as a 'meeting of the minds,' and as such it is not merely a replacement for fact-to-face, but a medium in its own right" (Pardoe 1984, p. 204). Pardoe found that "...distance teaching was a combined effort of school and centre staff, and strong links were created between individual teachers and teachers and children" (Pardoe 1984, p. 204).

The ability of the participants to interact with presenters and other participants was also found to be beneficial by Roeder in a study of continuing education for hospital-based pharmacists. Roeder did interject a note of caution regarding the effectiveness of teleconferences.

> The concept of teleconferencing is only as good as the content presented. Anyone wishing to use this medium should thoroughly study instructional design, the technical aspects and the strengths and weaknesses of networking before embarking on this venture. Audience acceptance also depends, in large measure, on the skill and style of the speaker; lecturers should be chosen carefully. Just as certain people may be outstanding instructors in a classroom environment and totally ineffective on videotape, the lack of face-to-face interaction may render otherwise superb speakers ineffective at teleconferencing.

> Training and experience are required by all involved in order for teleconferencing to be successful (Roeder, 1983, p. 118)).

In an early experimental study by Herminghaus on educational television, asked is "...it possible for a competent television teacher to teach large groups of students effectively without supplementary activities?" (Herminghaus, 1957, p. 120).. The experiment centered on teaching ninth grade science and ninth grade English composition. The experiment showed that television could be used for effective teaching.

> As measured by the testing instruments employed, students in large-group television classes in ninth-grade English composition and in ninth-grade general science showed a degree of achievement at least equal to that of students in control classes taught in the conventional manner (Herminghause 1957, p. 132).

Herminghaus surveyed student and teacher attitudes regarding education and found that students reported they could see experiments not available in the classroom, got the best teachers, and concentrated and listened more closely. On the negative side, they reported frustration in not being able to ask questions (Herminghaus 1957, p. 130).

Rosetti and Surynt sought to explain the comparative effectiveness of teleconferences to traditional face-to-face meetings.

> The implications of this finding are that even though the high technology videoteleconference may lack certain elements needed to create an interpersonal or 'warm' environment, it does provide enough visual and nonverbal stimuli to effectively simulate the productive aspects of a face-to-face meeting. It is also possible that because the more subtle aspects of an interpersonal setting are lacking, the individuals

> involved shift from an emphasis on interpersonal social exchange and concentrate more on the tasks at hand. Although further research is required to verify this hypothesis, it is possible that a face-to-face meeting allows too much opportunity for interpersonal 'noise' and is perhaps too "warm" for truly effective problem-solving (Rosetti and Surynt 1985, p. 29).

In a short experiment using telephone teleconferences for bringing college courses to the residents of nursing homes, Stanley and Munchow discerned attitudinal changes following the experience.

> The fact that all students appeared to maintain changed behaviors raised another issue. It seems unlikely that twelve classroom hours, during which students showed varying degrees of involvement, would be influential enough to explain fairly long-term change. A plausible explanation is that contact with the class and teacher may have changed staff behaviors by providing a reminder that residents could be valued contributors and take various forms of responsibility themselves (Stanley and Munchow 1988, p. 208).

According to an Office of Technological Assessment summary report on distance learning for the U.S. Congress, distance learning techniques, of which teleconferences are a primary medium, are as effective as face-to-face classroom instruction providing teachers change their teaching style and provide opportunities for interaction.

> In most instances, distance learning apears to be as effective as face-to-face instruction in the classroom. Since distance learning has been used primarily with adult learners--in industry and military training, higher and continuing education--most research has evaluated effectiveness in these settings. It is high. While the evidence is incomplete in K-12 education, preliminary results are encouraging. To be effective on these systems, teachers report that they must change their style and create new opportunites for interaction. Students report that they must work harder in courses offered at a distance but, they welcome the increased course options, responsibility for their own learning, and the oportunity to expand their community. Whether distance learning works

well with all students is yet to be determined (U.S. Congress, 1989, p. 1).

Brown summarizes the potential impact of video teleconferencing on learning:

> The live interactive video teleconference may be the 'next best thing to being there' since it serves as an alternative to face-to-face learning. Its potential as a learn/communication tool continues to unfold, and it is anticipated that its use will increase as more people gain an understanding of it. It does minimize the role of location in educational access; it has potential for bringing economic efficiency to highly specialized educational offerings; it enriches the distance learning experience through visual stimulation and human interaction. Its biggest point is that learning opportunities may be brought to thousands of individuals who previously could not participate in organized learning experiences. And the VT may make distance learning a more acceptable alternative to potential learners (Brown 1988, p. 10).

Participant Satisfaction Surveys

Though many researchers favor the application of teleconferences for educational uses, especially for teacher training, the overall effectiveness of teleconferences as a change agent in staff development is surmised rather than well-established through research. In most comparisons of the application of teleconferences for training and course instruction, where specific measurable objectives are present and known by the students, it has been found that teleconferencing is just as or more effective than other forms of instruction. When it comes to use of teleconferences for staff development, where objectives may not be well-stated, much of

effectiveness research relies on immediate opinion feedback from participants.

Phelps evaluated the 1987 NASA videoconference series for staff development of teachers. Teachers were asked to respond on the value and usefulness to themselves of several program components by assigning numbers ranging from 1 for most important to 5 for least important. The survey, responded to by 120 participants, was conducted immediately following the last teleconference in the series. In a another question, this time using a four-point scale with 4 indicating maximum agreement and 1 indicating maximum disagreement, information on current NASA projects and practical hands-on activities for use with students were ranked as most important by the participants. Interestingly, interaction was ranked least important by the participants (Phelps 1987, p. 4).

Information on current NASA projects	1.9
Educational activities for classroom	2.2
Receipt of educational materials	3.0
Announcement for educational products	3.6
Ability to interact with presenters	4.0

Using the same scale, Phelps also found that participants rated the overall effectiveness of the teleconferences for staff development at 3.04 and the relevancy of the teleconferences to their own situations at 3.24 (Phelps 1987, p. 5).

In some instances of teleconferencing, there appears to be a positive relationship of attitude to the teleconference to results and in other instances the relationship appears negative. As reported

earlier, research by Brown, Brown, and Danielson (1975) and Roeder (1983) has established that production values of teleconferences, such as the personality and skill of the presenter and the level of interaction the teleconference provides, do affect participant attitude and possibly effect learning.

Summary

The teleconference has become established as an important means of communication between widely spaced groups of people. Teleconferencing offers many potential advantages to users including cost-effectiveness and immediacy. Research indicated that teleconferences may be just as effective in accomplishing objectives as face-to-face meetings. In the use of teleconferences for teacher development, similar advantages are seen. However, often missing from research studies is a measure of the long-term effectiveness of teleconferences. Generally unknown is whether or not teachers actually make use of the content presented in teleconferences with the students they teach. Post-teleconference survey forms may not actually indicate how effective the teleconference was for the participants. Participants reporting, at the site and the time of the teleconference, that the teleconference content is useful is not necessarily the same as actually making use of the content at a later date.

CHAPTER III

DESIGN AND METHODOLOGY

Introduction

The primary purpose of this study is to determine if teachers voluntarily attending NASA educational satellite teleconferences have made use of the information presented in their classrooms. Selected for study was the January 21, 1989 NASA educational satellite teleconference titled *Future Explorations*. The one hour long program began at the Educational Television Service studios of Oklahoma State University in Stillwater, Oklahoma, with introductory announcements by William D. Nixon, Head of NASA's Educational Technology Branch and a brief video status report of the upcoming space shuttle flight. The program shifted to Dr. Robert Brown, Director of NASA's Educational Affairs Division. Dr. Brown, speaking from the NASA Lewis Research Center in Cleveland, Ohio, highlighted NASA's concern for the projected shortage of scientists, engineers, and technicians by the year 2000 and how this forecast might impact education. The program next shifted to Alan Ladwig, Director of Program Support and Special Projects at NASA. Mr. Ladwig spoke about possible future directions for NASA's manned and unmanned space programs. Mr. Ladwig was followed by Joe Nanninger, Deputy Chief of the Advanced Program Analysis Office at the NASA Lewis

Research Center. Mr. Nanninger spoke about possible energy systems for future space missions. Immediately following the conclusion of Mr. Nanniger's presentation, viewers were invited to place collect telephone calls to Oklahoma State University to ask questions of the speakers. At the conclusion of the questions and answers, Mr. Nixon made some announcements about new NASA publications. The program concluded with a series of classroom activity demonstrations presented by Dr. Dale Bremmer, Aerospace Education Specialist. Dr. Bremmer demonstrated activities on aerodynamic lift, gravitational force, center of mass, and conservation of momentum. The program concluded with a reminder of the date for the next broadcast.

Immediately following the program, teachers from the live viewing audience were asked to complete a brief survey instrument. The instrument, a modification of a previous instrument used for assessing the NASA teleconference series for the 1987-89 school year, sought to assess viewer acceptance of the program and to get their opinions concerning the usefulness of the program to them in their classroom teaching. For the purposes of this study, the instrument was modified with the addition of a Likert scale. Likert scales ask...

> ...an individual to respond to a series of statements by indicating whether she or he strongly agrees (SA), agrees (A), is undecided (U), disagrees (D), or strongly disagrees (SD) with each statement. Each response is associated with a point value, and an individual's score is determined by summing the point values for each statement (Gay 1987, p. 146).

In addition, the survey instrument was also modified with a request for the teachers to include their telephone numbers so they could be contacted at a later date for more information. Cooperating teachers were telephoned approximately six weeks following the teleconference and interviewed regarding their actual use of the content presented during the teleconference. The interviewer attempted to identify specific examples of teacher use of teleconference content with the students they teach that occurred as a result of their participation in the teleconference. Also, the teachers were asked for specific suggestions for improvements in the teleconference format, content, and level. Teacher telephone responses on actual content use were compared for congruency with their written responses on the initial survey instrument by use of the chi square statistical test for frequency data (Witte, 1985, pp. 260-274).

Type of Research Design

A simple descriptive research design was chosen for this study. Included were both inferential and status descriptive aspects. "Inferential statistics are concerned with determining how likely it is that results based on a sample or samples are the same results that would have been obtained for the entire population" (Gay 1987, p. 378). The sample consisted of self-selected teachers who voluntarily completed the post-teleconference survey instrument and gave permission to be telephoned for a follow-up interview at a later date. Teachers were asked, in the post-teleconference survey instrument,

to judge the effectiveness of the selected NASA educational satellite teleconference as a staff development tool, its relevancy to teachers, and whether or not the content presented would be of future use to them in their classrooms. During telephone interviews, conducted six weeks following the conclusion of the teleconference, participating teachers were asked to identify specific instances of how they made use of the teleconference content in their classrooms. The two surveys provided two sets of frequency data. Initial survey responses were compared to follow-up telephone survey responses and tested through the following null hypotheses:

Research Hypothesis One

> There is no significant relationship between teacher responses on the relevancy of program content item in the post-NASA educational satellite teleconference rating survey instrument and their actual subsequent classroom use of that program content.

Research Hypothesis Two

> There is no significant relationship between teacher responses on the effectiveness of program content item in the post-NASA educational satellite teleconference rating survey instrument and their actual subsequent classroom use of that program content.

Research Hypothesis Three

There is no significant relationship between teacher responses on the prediction of future use of program content item in the post-NASA educational satellite teleconference rating survey instrument and their actual subsequent classroom use of that program content.

In addition to inferential aspect, this study also includes a status descriptive aspect. Status descriptive surveys "...merely search for accurate information about the characteristics of particular subjects, groups, institutions, or situations or about the frequency with which something occurs" (Van Dalen, 1978, p. 285). In the post-teleconference survey, teachers were asked to rank the five components of the teleconference as to their relative importance. The components were:

1. information on current NASA projects,
2. educational activities for the classroom,
3. announcements of NASA educational products and services,
4. ability to interact with the presenters (e.g.,. question & answer), and
5. receipt of NASA educational materials after the conference (e.g., publications).

In a second status descriptive aspect, the accuracy of pre-teleconference teacher attendance estimates by site coordinators was compared to actual attendance whenever the totals were known. In

addition, teachers were asked, during the follow-up telephone calls, whether or not they have actually made use of teleconference content with the students they teach. Finally, teachers were asked, in the telephone interview, for specific suggestions for improvements in the teleconferences.

The information gathered through the post-teleconference survey form and through the follow-up telephone survey was aimed at answering the following research questions:

Research Question One

> Do teachers make use of the content of NASA educational satellite teleconferences with the students in the classes that they teach?

Research Question Two

> How do teachers, participating live in NASA educational satellite teleconferences, rank each of its five components presented in terms of relative importance?

Research Question Three

> In the opinions of teachers, participating live in NASA educational satellite teleconferences, how can future teleconferences be improved?

Research Question Four

How do pre-teleconference registration estimates of teachers to be in attendance for NASA educational satellite teleconferences compare to actual attendance totals?

Population

Selection of teachers for this study was based on NASA's educational satellite teleconference preregistration list. At the beginning of the 1987-88 school year, a total of 428 schools and educational organizations from across the United States and Canada preregistered for the teleconference series (Oklahoma State University, 1987, p. 1). Preregistration consisted of a simple identification form sent to site coordinators asking for information such as school name and address and the estimated number of teachers expected to see the teleconferences live. Also requested was a separate estimate of the number of teachers expected to see the teleconference on tape at a later date. No registration fees were charged for participation in any of the four promised teleconfernces.

Site coordinators for the 428 preregistering sites estimated 5,275 teachers would view each NASA educational satellite teleconference live (Oklahoma State University, 1987, p. 1). However, because preregistration took place prior to the first teleconference of the 1988-89 series, site coordinators made their teacher attendance estimates without the advantage of recent experience, bringing into question the accuracy of those estimates.

William Nixon, Head of NASA's Educational Technology Office, has pointed out the difficulty of obtaining accurate audience estimates.

> Numbers of schools and participants viewing each program is difficult to estimate accurately in educational satellite videoconferencing for the following reasons: (1) You only have feedback from those that have registered. The Series is promoted widely with satellite tuning information and many view the programs without bothering to register. (2) A high percentage of the sites tape the program due to difference in times zones and teacher release times. These tapes are viewed several times, sometimes by many different schools for staff development programs. There are several counties, regions and states with centers that downlink and provide the program to several schools in their area by a closed circuit television. (3) Teachers from several schools sometimes attend workshops that feature NASA satellite programs. (4) Several commercial cable systems provide this series as a service to schools in their area. (5) Many teachers invite students to observe the live program (Nixon, 1989, p. 5).

Preregistration forms did not include information regarding the background and experience of the participating teachers or the grade levels and subjects they teach. However, an end-of-the-series survey of the NASA educational teleconferences for the 1987-88 school year estimated the audience that year consisted of 66 percent secondary teachers, 22 percent elementary teachers, 8 percent teachers who teach at all levels, and nearly 4 percent college level teachers (Phelps, 1988, p. 3). No attempt was made in this survey to determine the range of subject areas taught by the participating teachers.

Sampling Plan and Data Collection

Without an accurate count of the teachers in attendance for the particular educational satellite teleconference under study, it was not possible to determine the size of a statistically valid random sample. Assuming a population size of 5,275 teachers, a randomly chosen sample of 357 subjects would be required (Isaac & Michael, 1981, p. 193). However, this population estimate and its corresponding representative sample was based on preregistration figures assembled several months in advance of the teleconference air time. To correct for this problem, and obtain a better population estimate, an attempt was made to reach 107 site coordinators by telephone three weeks prior to the teleconference air date. These site coordinators were selected on the basis of their live teacher audience estimates. Each estimated that at least 10 teachers would be in attendance. Cumulatively, they represented a preregistration estimate of 4,369 teachers or 83 percent of the total number of teachers expected to participate across the United States and Canada. Of the 107 site coordinators selected, 97 were actually reached and 63 agreed to participate in the study. Many of the non-participating site coordinators reported they had elected not to watch the teleconference live afterall. Others reported that they had preregistered with the intention of having satellite receiving equipment installed by the air dates of the teleconferences but their equipment had not arrived or had not yet been installed.

Each of the 63 cooperating site coordinators was asked to distribute survey instruments immediately following the

teleconference, collect the instruments, and return the instruments in post-paid envelopes that would be provided. During the initial telephone contact, each site coordinator was again asked to estimate the number of teachers that would be in attendance. Since the teleconference chosen for the study was the third in the series for the 1988-89 school year, new estimates were based on actual experience obtained in the two previous teleconferences held in October and November of 1987. Consequently, the revised estimate was likely be more accurate than the preregistration estimate. The cooperating site coordinators cumulatively estimated 841 teachers would be in attendance for the January 21, 1989 NASA educational satellite teleconference. Their cumulative revised estimate was approximately one-fifth the original cumulative estimate made prior to the start of the 1988-89 series. With the new population estimate, a randomly chosen sample of 260 teachers would be required to achieve a statistically valid random sample of the teacher population (Isaac & Michael, 1981, p. 193)

Two weeks prior to the air date of the selected teleconference, 841 survey instruments were mailed to the 63 cooperating site coordinators. The mailed instruments were included in a packet with an informational letter providing instrument administration instructions and a post-paid return envelope.

Three weeks following the teleconference, survey instrument packages were received from 29 sites. Site coordinators who had not yet returned survey instruments were telephoned to remind them to do so. Follow-up telephone contacts with non-responding site coordinators again indicated over-estimates of teacher attendance.

Only 19 non-responding site coordinators were reached by telephone and of this number, 7 reported they did not watch the program or that they had recorded it for later viewing. The twelve non-responding coordinators who did use the teleconference live reported actual teacher audience counts of less than half of their revised estimate.

Eventually, 181 evaluation instruments from 29 sites were returned. Of the returned instruments 6 were unusable for various reasons, 126 indicated a willingness to be telephoned for a follow-up interview by voluntarily supplying their names and telephone numbers, and 49 did not grant permission for a follow-up telephone interview.

Six weeks following the teleconference, follow-up telephone interviews with the cooperating teachers were conducted. A total of 103 teachers were reached and questioned about their use of the content of the teleconference with their students.

Instrument

The survey method was used for the gathering of information regarding teacher acceptance of teleconference content and their actual use of that content with their students. Two survey instruments were developed by the researcher (see Appendix B and C). The first was a post-teleconference participant survey. It consisted of 12 questions asking first for information about the subjects and grade levels the respondents taught. Also asked of the teachers was how they viewed the teleconference and whether or

not they were willing to participate in future teleconferences. Finally each teacher was asked to rank the importance of the five components of the teleconference and express their opinions regarding the relevancy of the teleconference, its effectiveness as a staff development program, and their expected use of program content with their students.

The second survey instrument, a telephone interview form, sought specific information on the actual classroom uses teachers made of the teleconference content. This instrument was completed by the interviewer. Also requested, were specific suggestions for how NASA educational satellite teleconferences could be improved.

Analysis of Data

Chosen for statistical testing of the null hypotheses was the chi square test of significance for frequency data. According to Guilford and Fruchter, chi square is used...

> ...with data in the form of frequencies, or data that can be readily transformed into frequencies. This includes proportions and probabilities. One important feature of chi square is its additive property, which makes possible the combination of several statistics or other values in the same test. Thus, a hypothesis involving more than one set of data can be tested for significance (Guilford and Fruchter, 1973, p. 195).

The data used in the chi square analysis are the observed frequencies that are determined by direct observation of a phenomena or by experiment and the theoretical frequencies that are generated by hypotheses. Chi square asks if "...the differences

between the observed and theoretical frequencies be considered to result from sampling error" (Ferguson, 1971, p. 174). In other words, what is the probability that the difference between the observed and the expected frequencies is greater than can be expected through the workings of chance? Gay observes that the chi square statistic...

> ...is a nonparametric test of significance appropriate when the data are in the form of frequency counts occurring in two or more mutually exclusive categories...A chi square test compares proportions actually observed in a study with proportions expected, to see if they are significantly different. Expected proportions are usually the frequencies which would be expected if the groups were equal (Gay 1987, p. 397).

Huntsberger and Billingsley further explains that the chi square distribution is...

> ...continuous distribution ordinarily derived as the sampling distribution of a sum of squares of independent standard normal variables. It is a skewed distribution such that only non-negative values of the variable X^2 are possible, and it depends upon a single parameter, the degrees of freedom (Huntsberger and Billingsley, 1981, p. 336).

To calculate the value of chi square, the difference between the observed frequencies and the expected frequencies are squared and summed and divided by the expected frequencies. (Ferguson, 1971, p. 174). The actual equation used follows:

$$X^2 = \sum \frac{(f_o - f_e)^2}{f_e}$$

f_o frequency observed

f_e frequency expected

(Witte, 1985, p. 268)

According to Ferguson, the value of chi square is "...related to the size of the sample. If an actual difference exists between observed and expected values, this difference will tend to increase as the sample size increases" (Ferguson, 1971, p. 190). To test for significance, the chi square value is compared to a chi square table. Tabled values are related to the number of degrees of freedom by which the frequencies are free to vary and the probability that the result could be due to the workings of chance

To make use of the chi square test in this study, the data collected through the Likert instrument was collapsed into three categories. "Strongly Agree" and "Agree" became the single category of "Agree" because each were positive statements. The "Neutral" category remained the same and the categories of "Disagree" and "Strongly Disagree" were combined into a single category of "Disagree" since each were negative statements. The actual number

of uses teleconference content by the cooperating teachers with their students was also collapsed and organized into two categories of either "Use" or "Nonuse." Collapsing the response categories permitted a simplified two-way chi square test to be employed. The results from this test were applied to a critical values of chi square table to estimate the level of confidence that the acceptance or rejectance of the null hypothesis was indeed correct (Witte 1985, p. 375).

Data gathered in the status descriptive aspect of this study are presented in tabular form and interview quotations regarding specific classroom uses of teleconferences as well as suggestions for improvement are included in Appendix D and E.

Summary

Post-teleconference survey instruments were distributed to 63 teleconference viewing sites for the NASA *Future Explorations* Educational Satellite Videoconference held on January 21, 1988. By means of the chi square statistical test for frequency data, teacher responses to survey questions on the relevancy, effectiveness, and expected future use of the teleconference content were compared to actual classroom use of that content. Furthermore, research questions concerning the relative importance of the five components that NASA Educational Satellite Videoconferences are divided into, how to improve future teleconferences, and the accuracy of pre-teleconference teacher attendance estimates by site coordinators

were asked. Chapter IV will present the results of the data collection.

CHAPTER IV

ANALYSIS OF THE DATA

The purpose of this study was two-fold. First, the researcher sought to determine if teachers voluntarily attending NASA educational satellite teleconferences had made use of the information presented in their classrooms. Three research hypotheses were tested regarding the relationship between teacher opinions on the relevancy, effectiveness, and usefulness of the teleconference and their actual subsequent use of program content in their respective classrooms. The three research hypotheses, tested in the null, were:

Research Hypothesis One

> There is no significant relationship between teacher responses on the relevancy of program content item in the post-NASA educational satellite teleconference rating survey instrument and their actual subsequent classroom use of that program content.

Research Hypothesis Two

> There is no significant relationship between teacher responses on the effectiveness of program content item in the post-NASA educational satellite teleconference rating survey instrument

and their actual subsequent classroom use of that program content.

Research Hypothesis Three

There is no significant relationship between teacher responses on the prediction of future use of program content item in the post-NASA educational satellite teleconference rating survey instrument and their actual subsequent classroom use of that program content.

The second purpose of this study was to gather data on NASA teleconferences that could be useful to future planning. Teachers were asked on the post-teleconference survey instrument for their opinions regarding the value of five different components that NASA teleconfernces are divided into. These include:

1. information on current NASA projects (e.g., Aeronautics, Living In Space),
2. educational activities for the classroom,
3. announcements of NASA educational products and services,
4. ability to interact with the presenters (e.g.,. question & answer), and
5. receipt of NASA educational materials after the conference (e.g., publications).

During follow-up telephone calls, teachers were asked whether or not they have actually made use of teleconference content with the students they teach and for their opinions on how to improve

future teleconferences. Finally, data was collected on the accuracy of pre-teleconference teacher attendance estimates by site coordinators. Four research questions were asked:

Research Question One

Do teachers make use of the content of NASA educational satellite teleconferences with the students in the classes that they teach?

Research Question Two

How do teachers, participating live in NASA educational satellite teleconferences, rank each of its five components presented in terms of relative importance?

Research Question Three

In the opinions of teachers, participating live in NASA educational satellite teleconferences, how can future teleconferences be improved?

Research Question Four

How do pre-teleconference registration estimates of teachers to be in attendance for NASA educational satellite teleconferences compare to actual attendance totals?

Data Gathering

A total of 428 viewing site coordinators, representing 5,275 teachers, preregistered for the 1988-1989 school year NASA Educational Satellite Videoconference series. Attempts were made to contact all sites indicating that ten or more teachers would be in attendance to view the teleconference. Of the 103 sites meeting this criteria, comprising 4,382 teachers or 83.1 percent of the total registration, 97 were contacted by telephone two weeks prior to the teleconference program date. Site coordinators at 63 sites agreed to cooperate in the study by distributing survey instruments and returning them by mail. During the telephone contact, site coordinators revised their teacher attendance estimate and requested 841 survey forms.

Survey forms were returned from 29 sites by three weeks following the teleconference. The returned survey forms totaled 181. Six of the forms were from students or were improperly completed and were not usable. Of the remainder, respondents on 126 forms volunteered to be interviewed by telephone six weeks following the teleconference and 49 declined to be interview.

During the sixth week following the teleconference, telephone calls were placed to all cooperating teachers. Eventually, 103 teachers were reached and interviewed. Each was asked specifically if and how they used the content of the teleconference with the students in the classes that they teach? Each was also asked to make any suggestions they could think of to improve future teleconferences.

Twenty-five teachers responded to the question of if and how they made use of teleconference content with their students by saying that the curriculum unit in which the teleconference content would fit had already passed and would not be taught again until the following school year. Those teachers were then asked if they would use the content when the time came and how they would use it. For data collection purposes, responses from those teachers were kept separate from the other 78 teachers who did not express this problem. Consequently, each research hypotheses was tested twice, once without those 25 teachers included in the total and once with them included in the total. Although these 25 teachers promised to make use of program content with their students the next school year, their failure to use that content within six weeks of the teleconference air date was counted as a negative response in the second analysis because they had not made use of the program content.

Testing of the research hypotheses was accomplished through the chi square two-way classification. This classification was used to compare the observed frequency of teacher responses to survey questions relating to the relevancy, effectiveness, and expected use of teleconference content with the actual use of that content in the respective classrooms of the teachers. The chi square classification requires summing the squared differences between the observed frequencies and the expected frequencies divided by the expected frequency in each cell of a two-way grid. The result obtained is then compared to a theoretical value on a chi square level of significance table. In this study, the research hypotheses were tested to the .05

level of significance for two degrees of freedom. In a two-way chi square classification, the number of degrees of freedom is determined by multiplying the number of categories in the column minus one by the number of categories in the row minus one. A two category column by three category row yields a value of two degrees of freedom. According to the level of significance table, the calculated chi square value must exceed 5.99 in order for the null hypothesis to be rejected (Bartz, 1988, p. 458).

The determination of the expected frequency was based on the number of responses for each category on the survey. For the purposes of this study, the categories of "Strongly Agree" and "Agree" were grouped together as positive statements under the "Agree" category. "Disagree" and "Strongly Disagree" were combined under the "Disagree" category because both are negative statements. The "Neutral" category remained as is. With this grouping accomplished, the determination of expected frequency for each of the three resulting categories was simply a matter of dividing the total number of responses in each category by two. For example, if there were no significant relationship between positive responses on the survey and the actual classroom use of teleconference content, the values of both cells in the two-way chi square classification grid would be equal. In other words, half of the teachers that responded positively to the relevancy survey item would make use of the program content with their students and half would not. The same would apply for the neutral and negative responses to the survey items.

Research Hypothesis One Analysis

There is no significant relationship between teacher responses on the relevancy of program content item in the post-NASA educational satellite teleconference rating survey instrument and their actual subsequent classroom use of that program content.

This hypothesis compared the post teleconference survey question on relevancy to actual classroom use of the teleconference content. ("The subject matter of *Future Exploration* was relevant to me.") Table I below provides the observed frequencies and the expected frequencies for each of the categories in the two-way chi square classification for the relevancy survey item. Table I does not include the 25 teachers who reported the appropriate classroom unit had already passed.

TABLE I

RELEVANCY AND ACTUAL CLASSROOM USE
OBSERVED AND EXPECTED FREQUENCIES

	Agree	Neutral	Disagree
Used activities	$f_o = 58$ $f_e = 36$	$f_o = 0$ $f_e = 1$	$f_o = 2$ $f_e = 2$
Did not use activities	$f_o = 14$ $f_e = 36$	$f_o = 2$ $f_e = 1$	$f_o = 2$ $f_e = 2$
Total	72	2	4

The chi square calculation for the data from Table I yielded a value of 27.88. The value exceeds the tabled chi square level of significance value at the .05 level for two degrees of freedom. Research Hypothesis One is rejected.

Table II below below provides the observed frequencies and the expected frequencies for each of the categories in the two-way chi square classification for the relevancy survey item. Table II does include the 25 teachers who reported the appropriate classroom unit had already passed.

TABLE II

RELEVANCY AND ACTUAL CLASSROOM USE
(ALL SCORES)
OBSERVED AND EXPECTED FREQUENCIES

	Agree	Neutral	Disagree
Used activities	$f_o = 58$ $f_e = 48.5$	$f_o = 0$ $f_e = 1$	$f_o = 2$ $f_e = 2$
Did not use activities	$f_o = 39$ $f_e = 48.5$	$f_o = 2$ $f_e = 1$	$f_o = 2$ $f_e = 2$
Total	97	2	4

The chi square calculation for the data from Table II yielded a value of 5.72. The value does not exceeds the tabled chi square level of significance value at the .05 level for two degrees of freedom.

When all data are included in the chi square classification, Research Hypothesis One is accepted.

Research Hypothesis Two Analysis

> There is no significant relationship between teacher responses to the effectiveness of program content item in the post-NASA educational satellite teleconference rating survey instrument and their actual subsequent classroom use of that program content.

This hypothesis compared the post teleconference survey question on the effectiveness of the program to actual classroom use of the teleconference content. ("*Future Exploration* was an effective staff development program for me.") Table III below provides the observed frequencies and the expected frequencies for each of the categories in the two-way chi square classification in the effectiveness survey item. Table III does not include the 25 teachers who reported the appropriate classroom unit had already passed.

TABLE III

EFFECTIVENESS AND ACTUAL CLASSROOM USE
OBSERVED AND EXPECTED FREQUENCIES

	Agree	Neutral	Disagree
Used activities	$f_o = 53$ $f_e = 34$	$f_o = 4$ $f_e = 2.5$	$f_o = 3$ $f_e = 2.5$
Did not use activities	$f_o = 15$ $f_e = 34$	$f_o = 1$ $f_e = 2.5$	$f_o = 2$ $f_e = 2.5$
Total	68	5	5

The chi square calculation for the data from Table III yielded a value of 23.24. The value exceeds the tabled chi square level of significance value at the .05 level for two degrees of freedom. Research Hypothesis Two is rejected.

Table IV below provides the observed frequencies and the expected frequencies for each of the categories in the two-way chi square classification for the effectiveness survey item. Table IV does include the 25 teachers who reported the appropriate classroom unit had already passed.

TABLE IV

EXPECTED AND ACTUAL CLASSROOM USE
(ALL SCORES)
OBSERVED AND EXPECTED FREQUENCIES

	Agree	Neutral	Disagree
Used activities	$f_o = 53$ $f_e = 44.5$	$f_o = 4$ $f_e = 4$	$f_o = 3$ $f_e = 3$
Did not use activities	$f_o = 36$ $f_e = 44.5$	$f_o = 4$ $f_e = 4$	$f_o = 3$ $f_e = 3$
Total	89	8	6

The chi square calculation for the data from Table IV yielded a value of 3.24. The value does not exceeds the tabled chi square level of significance value at the .05 level for two degrees of freedom. When all data is included in the chi square classification, Research Hypothesis Two is accepted.

Research Hypothesis Three Analysis

There is no significant relationship between teacher responses on the prediction of future use of program content item in the post-NASA educational satellite teleconference rating survey instrument and their actual subsequent classroom use of that program content.

This hypothesis compared the post teleconference survey question on expected classroom use to actual classroom use of the

teleconference content. ("I will be able to use the content of Future *Exploration* in my classroom.") Table V below provides the observed frequencies and the expected frequencies for each of the categories in the two-way chi square classification for the expected survey item. Table V does not include the 25 teachers who reported the appropriate classroom unit had already passed.

TABLE V

EXPECTED AND ACTUAL CLASSROOM USE
(ALL SCORES)
OBSERVED AND EXPECTED FREQUENCIES

	Agree	Neutral	Disagree
Used activities	$f_o = 53$ $f_e = 34$	$f_o = 5$ $f_e = 3.5$	$f_o = 2$ $f_e = 1.5$
Did not use activities	$f_o = 15$ $f_e = 34$	$f_o = 2$ $f_e = 3.5$	$f_o = 1$ $f_e = 1.5$
Total	68	7	3

The chi square calculation for the data from Table V yielded a value of 22.86. The value exceeds the tabled chi square level of significance value at the .05 level for two degrees of freedom. Research Hypothesis Three is rejected.

Table VI below below provides the observed frequencies and the expected frequencies for each of the categories in the two-way chi square classification for the expected use survey item. Table VI

does include the 25 teachers who reported the appropriate classroom unit had already passed.

TABLE VI

EXPECTED AND ACTUAL CLASSROOM USE
(ALL SCORES)
OBSERVED AND EXPECTED FREQUENCIES

	Agree	Neutral	Disagree
Used activities	$f_o = 53$ $f_e = 46$	$f_o = 5$ $f_e = 4$	$f_o = 2$ $f_e = 1.5$
Did not use activities	$f_o = 39$ $f_e = 46$	$f_o = 3$ $f_e = 4$	$f_o = 1$ $f_e = 1.5$
Total	92	8	3

The chi square calculation for the data from Table VI yielded a value of 2.98. The value does not exceeds the tabled chi square level of significance value at the .05 level for one degree of freedom. When all data is included in the chi square classification, Research Hypothesis Three is accepted.

Research Question One Analysis

Do teachers make use of the content of NASA educational satellite teleconferences with the students in the classes that they teach?

During the follow-up telephone contacts with the 103 teachers who participated in the study, each was asked if they had actually made use of the content presented in the teleconference with their students. Sixty teachers or 58 percent of the total number of participating teachers conducted one or more teleconference content-based activities with their students Appendix D provides specific details on the nature of those activities. In general, teachers made use of the content in class discussions, activities, projects, and taped replays of portions of the teleconference for student viewing. Twenty-five teachers, or 24 percent of the teachers, responded to the question of use by saying the relevant unit in their curriculum had passed for the year and there was no opportunity to make use of the content with their students. Another 19 teachers, or 18 percent, made no use at all of the content.

Research Question Two Analysis

How do teachers, participating live in NASA educational satellite teleconferences, rank each of its five components presented in terms of relative importance?

NASA Educational Satellite Videoconferences are normally divided into five components. The first and most lengthy of these components is the NASA Project Information segment. It is here that NASA experts describe the current state of their research and what is expected in the future. In the second component, a teacher demonstrates hands-on activities for student involvement. The third component is a description of recent NASA educational materials and

the fourth provides time for telephone interaction with the presenters. The fifth component does not involve teleconference time. It consists of supplementary teaching materials being given to site coordinators for distribution to the teachers present.

One question in the post-teleconference survey form addressed the relative importance of the five teleconference components. Teachers were asked to rank the following elements of NASA Education Videoconferences in order of importance to you (1 = Most Important, 5 = Least Important). The numbers assigned to five components by the teachers provided a simple mathematical analysis of the relative importance of each. For the analysis, the point values were totaled and divided by the number of teachers (see Table VII). Low mean scores rank greater in importance to the teachers than do high mean scores. Because, the teachers responding to the survey divided themselves into two groups according to their willingness to be interviewed, separate means were determined for each group to see if there were any differences between those teachers who wanted to be interviewed and those who did not.

TABLE VII

TELECONFERENCE COMPONENT RANKING
BY INTERVIEW AND
NON-INTERVIEW GROUPS

	Interview Group	Non-Interview Group
	Mean	Mean
NASA Project Information	2.16	2.41
Classroom Activities	2.23	1.92
Product Information	3.54	3.35
Interaction	4.32	4.22
Educational Material Receipt	2.96	3.00

Table VIII rearranges the data in Table VII so that the importance rankings of the two teacher groups can be compared more simply

TABLE VIII

TELECONFERENCE COMPONENT RANKING
BY INTERVIEW AND
NON-INTERVIEW GROUPS

Importance Rank	Interview Group	Non-Interview Group
1	NASA Project Information	Classroom Activities
2	Classroom Activities	NASA Project Information
3	Educational Material Receipt	Educational Material Receipt
4	Product Information	Product Information
5	Interaction	Interaction

Research Question Three Analysis

In the opinions of teachers, participating live in NASA educational satellite teleconferences, how can future teleconferences be improved?

During the follow-up telephone calls to teachers indicating on their survey forms their willingness to be interviewed, each teacher was asked for specific suggestions as to how NASA educational satellite teleconferences could be improved. A complete list of these suggestions is contained in Appendix E.

In general, there was no consistent thread of ideas for improvement that tied together the comments from the 103 teachers

who were reached by telephone. However, frequently mentioned was the value of the activity demonstrations. Twenty teachers wanted written copies of each activity to be distributed during the teleconference. Several teachers wanted the activity session to be lengthened. Eight teachers pointed to the shortness of the question and answer interaction period and would like to have the interaction session lengthened somewhat while one thought it to be a waste of time.

From teacher comments, it was apparent that a number of them observed the teleconference with their students and recommended improvements to make the programs more interesting for the students. Eleven of the teachers wanted the content and vocabulary level lowered to be more appropriate for their students while three teachers wanted it raised. A few teachers commented on the presentation style of the speakers or the particular time of the day that the teleconference was aired.

Research Question Four Analysis

How do pre-teleconference registration estimates of teachers to be in attendance for NASA educational satellite teleconferences compare to actual attendance totals?

From the beginning of this study it became apparent that the preregistration numbers for teachers who would be watching the teleconference were grossly inflated. Several weeks prior to the teleconference, an attempt was made to contact by telephone every site coordinator who preregistered ten or more teachers for a live

viewing of the teleconference. Of the 428 registered sites, representing a total of 5,275 teachers, 103 sites met the criteria of estimating ten or more teachers would be in attendance to participate in the teleconverence live. The site coordinators for the 103 sites estimated an audience 4,382 teachers or 81.3 percent of the total 5,275 teachers for all the preregistered sites. Eventually, 97 site coordinators from this group were reached by telephone. Sixty-seven site coordinators agreed to cooperate with the survey by passing out survey forms immediately following the teleconference. The other site coordinators declined to participate because they had decided not to watch the teleconference live afterall or that the satellite receiving equipment they had expected to be installed in time, was not ready yet. During the telephone contact, all site cooperating site coordinators were asked for a new estimate of the teachers who would be in attendance. Their cumulative estimate was only 841 teachers. Their drop in the estimated audience, to just 16 percent of the original estimate, was most likely due to their recent experience of having hosted two previous NASA educational satellite ideoconference in the fall semester of that same school year. Consequently, they were basing their revised estimates on recent experience.

A further indication of overestimating teacher audiences by site coordinators came from follow-up telephone calls to site coordinators who had failed to return the survey forms following the teleconference as they had agreed. A few off the non-responding site coordinators who were reached by telephone stated that their satellite equipment had malfunctioned or had been preempted for

another function. Site coordinators who did host a viewing session but did not return survey instruments, indicated fewer than half the teachers they had expected to attend, in their revised estimates a few weeks before the air time, actually did attend.

Additional Data Acquired

Although not specifically addressed in either the research hypotheses or in the research questions, one additional set of data on the effectiveness of NASA educational satellite videoconferences was acquired through the post-teleconference survey instrument. Teachers were asked, "Do you plan to participate in future NASA teleconferences?" The teachers were permitted to answer yes, no, or unsure. Table VIII presents the results of this question.

TABLE IX

COMPARISON OF INTERVIEW VS NON-INTERVIEW GROUPS ON INTENTION TO VIEW NEXT VIDEOCONFERENCE

	Interview Group	Non-Interview Group
	N[a]	N[a]
Yes	90	19
No	2	1
Unsure	19	17
Total	111	37

Data for teachers willing to be interviewed and for those teachers not willing to be interviewed were counted separately. Eighty-one percent of the teachers who were willing to be interviewed responded "yes" to this question while only 51 percent of the non-interview group responded "yes." "No" responses for the interview group amounted to 17 percent while "no" responses for the non-interview group totaled 46 percent. In summary, teachers willing to be interviewed were more positive about the teleconference by indicating a willingness to attend future programs while teachers unwilling to be interviewed were more negative.

Summary

The chi square statistical analysis for frequency data was determined for each of the three research null hypotheses and data were compiled for the three research questions of this study. Chapter V will present the results, conclusions, and recommendations arising from this study.

CHAPTER V

RESULTS, CONCLUSIONS, AND RECOMMENDATIONS

Summary of the Study

On January 21, 1989, the Educational Technology Branch of the National Aeronautics and Space Administration's Educational Affairs Division hosted a one-hour-long educational satellite teleconference for teachers in widely spaced receiving sites across the United States. The program, entitled *Future Explorations*, sought to inform teachers about NASA's long-range plans for solar system exploration. The program also included a telephone question and answer session and an activity demonstration session. The purpose of the teleconference was to provide teachers with information and teaching ideas that could be used with students in the classes that they teach?

Although NASA assumes that educational satellite teleconferences are an effective delivery medium for teacher development, no evaluation of that assumption had been conducted. The purpose of this study was to try to determine whether teachers attending the videoconference considered it effective by later making use of the content presented during the teleconference with their students. Secondary objectives of the study included a comparison of teacher responses to questions of effectiveness, relevancy, and expected future use of teleconference content on a

post-teleconference survey instrument with actual classroom use of that content as determined through a follow-up telephone survey. Another secondary objective compared pre-teleconference audience estimates with actual attendance figures.

All study objectives were organized under three research hypotheses and four research questions. Research hypotheses were tested through the use of the chi square equation for frequency data. Research questions were investigated through simple data tabulation and arithmetic mean determination.

Results - Research Hypotheses

Immediately following the January 21, 1989, NASA educational satellite teleconference, participating teachers were asked to complete a one-page survey form. Three questions specifically addressed whether or not teachers found the teleconference relevant to them, effective as a staff development tool, and whether or not they would be able to use the teleconference content with their students. The answers to these three questions were compared to verbal responses those same teachers made during follow-up telephone calls placed approximately six weeks later.

The congruency between the survey responses and the verbal responses was addressed with the following three research hypotheses stated in the null:

Research Hypotheses One

There is no significant relationship between teacher responses on the relevancy of program content item in the post-NASA educational satellite teleconference rating survey instrument and their actual subsequent classroom use of that program content.

Research Hypotheses Two

There is no significant relationship between teacher responses on the effectiveness of program content item in the post-NASA educational satellite teleconference rating survey instrument and their actual subsequent classroom use of that program content.

Research Hypotheses Three

There is no significant relationship between teacher responses on the prediction of future use of program content item in the post-NASA educational satellite teleconference rating survey instrument and their actual subsequent classroom use of that program content.

Although subtle differences exist between the terms "relevant," "effective," and "use," each of the three survey items, in essence, looked at the value of the teleconference to the teacher. In otherwords, if the teleconference was relevant to the teacher, the

teacher would be able to make professional use of its content. The same contention applies to the teleconference effectiveness. Finally, whether or not the content would be used with the students, specifically addressed the issue.

During the study, one unanticipated problem was encountered that impacted on the answer to the research hypotheses. Twenty-five of the 103 teachers eventually reached for the follow-up telephone interviews reported that the relevant curriculum unit in which the teleconference content applied had already passed and would not be taken up again until the next school year. Although all 25 teachers promised to make use of the content then, none had done so during the six weeks following the teleconference. Consequently, two separate analyses with the chi square equation were conducted for each research hypothesis. The first eliminated those 25 teachers, reducing the survey group to 78 teachers and the second analysis included them in the totals as negative (did not use) responses.

Data analysis for the three research hypotheses, including only the first teacher group and then including all teachers, yielded conflicting results. All three hypotheses were rejected when the teacher group did not include the 25 teachers whose appropriate curriculum unit had passed. In other words, a relationship did exist between answers to survey questions on the relevancy, effectiveness, and the expected future use of teleconference content and actual use of that content six weeks later. This means that a teacher responding to questions on relevancy, effectiveness, and expected future use of the teleconference content was likely to make

use of it in the classroom. Conversely, a teacher responding negatively to those questions was not likely to make use of the content. However, when all teachers were included in the analysis, the research hypotheses were accepted. In other words, in this event a relationship did not exist between between answers to survey questions on the relevancy, effectiveness, and the expected future use of teleconference content and actual use of that content six weeks later. Teachers responding negatively to those questions were just as likely to make use of the content as those responding positively.

Results - Research Questions

In the matter of the research questions, four questions were asked:

Research Question One

> Do teachers make use of the content of NASA educational satellite teleconferences with the students in the classes that they teach?

Research Question One gets to the heart of this study. By hosting educational satellite teleconferences, the National Aeronautics and Space Administration attempts to help students learn about NASA activities and results and encourage some of them to begin careers in scientific, engineering, and technical fields. NASA does this by supporting teachers through programs and materials. Although it would be very difficult to determine how effective

NASA's educational satellite teleconferences are in encouraging students to engage in scientific, engineering, and technical careers, it is possible to determine if teachers use teleconference content with their students. Use of the content is an important step toward achieving the larger goal.

During telephone interviews with 103 teachers, 60 teachers or 58 percent of the total number of teachers reported actually making use of the teleconference content with their students. Instances of use varied from one to as many as three per teacher. Teachers reported discussions, demonstrations, research projects, and teleconference videotape replays with the students (see Appendix D.). If the 25 teachers who reported that the relevant curriculum unit had passed are not included with the rest of the teachers, the number of teachers making use of teleconference content jumps to 77 percent of the total.

A further indication of the teleconference effectiveness comes from one of the other questions in the post-teleconference survey. Teachers were asked, "Do you plan to participate in future NASA Videoconferences?" In the tabulation of this question, it was possible to include teachers who did not volunteer to be interviewed. Of a total of 148 teachers, 109 or 74 percent answered yes, 3 or 2 percent said no, and 36 or 24 percent were unsure.

Research Question Two

> How do teachers, participating live in NASA educational satellite teleconferences, rank each of its five components presented in terms of relative importance?

Research Question Two asked teachers to rank each of the five components NASA educational satellite teleconferences are divided into in the order of preference. Because not all teachers responding to the survey volunteered to be interviewed by telephone, it was possible to compare two groups of teachers--those willing to be interviewed and those unwilling to be interviewed. The group willing to be interviewed favored the five teleconference components in the following order from most important to least important: NASA Project Information, Classroom Activities, Educational Material Receipt, Product Information, and Interaction. The teacher group unwilling to be interviewed favored the five teleconference components in the following order from most important to least important: Classroom Activities, NASA Project Information, Educational Material Receipt, Product Information, and Interaction.

Except for reordering the first two components, NASA Project Information and Classroom Activities, both groups agreed very closely on the relative importance of the five components.

Research Question Three

> In the opinions of teachers, participating live in NASA educational satellite teleconferences, how can future teleconferences be improved?

Research Question Three asked teachers, during the follow-up telephone interviews, for specific suggestions as to how future NASA educational satellite teleconferences could be improved. Suggestions for improvement ranged widely (see Appendix E). Most frequently mentioned were the activity demonstrations and the desire for more activities. Many teachers requested written copies of the activities to be distributed during the teleconference. Although the interaction segment of the teleconference was the lowest rated by all teachers of all teleconference components, several teachers wanted the interaction section expanded. Other suggestions related to the level of the teleconference to better match the levels of their students. Since the teleconference was open to all teachers, level adjustment suggestions varied from make it higher to make it lower.

Research Question Four

> How do pre-teleconference registration estimates of teachers to be in attendance for NASA educational satellite teleconferences compare to actual attendance totals?

Research Question Four examined accuracy of pre-teleconference teacher attendance estimates by site coordinators with actual teacher attendance. Only site coordinators estimating

that at least 10 or more teachers would see the teleconference live were involved in the study. One hundred three of the original 428 sites met this criteria. These selected sites represented 4,382 or 81.3 percent, of the total number of teachers estimated for all sites.

When the chosen site coordinators were contacted prior to the teleconference to elicit their assistance, the site coordinators were again asked to estimate teacher attendance. By this time, the coordinators had had the recent experience of hosting two teleconferences and the opportunity to make more realistic estimates of teacher attendance. Ninety-seven site coordinators were reached and only 67 coordinators reported they were using the teleconference live. The rest of the coordinators, for a variety of reasons, had decided to record the teleconference or not receive it at all. The cooperating site coordinators revised their teacher estimates to 841 or 16 percent or the origionial total.

Following the teleconference, survey forms plus follow-up telephone calls to non-responding site coordinators indicated that fewer than half of the teachers expected in the revised estimates actually showed up for the teleconference. Furthermore, the responding 29 sites returned only 171 survey forms.

Conclusions

Educational satellite videoconferences are becoming an important means of disseminating information to widely spaced individuals on a timely basis. Although it is not possible here to determine whether or not NASA educational satellite teleconferences

are less, as, or more effective than traditional face-to-face teacher workshops, it can be stated that the January 21, 1989 *Future Explorations* teleconference did encourage many of the responding teachers (about 60 percent) to make use of the content presented with their students. Furthermore, 74 percent of all responding teachers stated they will participate in future teleconferences and only 2 percent said they would not. Considering that attendance is voluntary, their willingness to join future teleconferences is a strong positive indication of the effectiveness of NASA educational satellite teleconferences.

In the matter of the congruency of the responses to post-teleconference survey questions on the relevancy, effectiveness, and expected future use to actual use of the program content in the classroom, results are not so clear because of the curriculum unit problem that surfaced during the study. By the assurance of the 25 teachers involved that they would have used the content had the appropriate curriculum unit not passed, we can get at least an indication of what might had been. It appears that post-teleconference survey questions relating to the perceived effectiveness of teleconferences by participants to their work may be a useful indicator of true effectiveness. Positive responses may accurately predict actual future use of program content.

In the matter of pre-teleconference estimates of teacher attendance, it is clear, in the experience of the NASA educational satellite teleconference in question, that some site coordinators tended to widely over estimate expected teacher attendance. However, it can in no way be stated that only a small number of

teachers actually saw the teleconference live. Many receiving sites record teleconferences for later repeated use. Other receiving sites may simply have not bothered to register. Furthermore, it should be pointed out that though educational satellite teleconferences have been possible for many years, only recently have many schools begun to acquire the necessary receiving equipment and the administrative support and encouragement to do so. In the three years NASA has been hosting the current series of educational satellite teleconferences, the number of receiving sites has tripled. As more receiving sites come on line, the potential teacher audience will multiply dramatically.

Recommendations

The results of this study answered several question and provided valuable data for consideration in the development of future NASA educational satellite teleconferences. Based on this study, the following recommendations are made:

1. The Educational Affairs Division of the National Aeronautics and Space Administration should continue with its educational satellite teleconferences and increase the number of programs offered each school year. Programs, in addition to the successful current series that is of general interest to all teachers, should be held specifically for teachers of different academic disciplines and grade levels as well as programs that are designed for students.

2. NASA educational satellite videoconferences should place greater emphasis on activity demonstrations and distribution of handout materials.

3. Additional long-term follow-up studies on educational satellite teleconferences should be conducted to investigate further the relationship between teacher estimates of teleconference effectiveness on post-teleconference survey forms and actual later classroom use of teleconference content. Such research may confirm that positive ratings on post-teleconference survey forms do translate into actual use of the teleconference content in the classroom. It should also identify specific ways in which teleconference content is employed in the classroom, which may possibly lead to future program adjustments encouraging further use.

4. Researchers should use great caution when using pre-teleconference teacher attendance estimates when planning future studies.

5. Researchers should conduct a comparison study of the relative effectiveness of educational satellite teleconferences for teachers and comparable face-to-face teacher workshops.

6. The National Aeronautics and Space Administration should pay closer attention to local site coordinators and provide

assistance on teleconference promotion and viewing site organization to encourage greater local teacher participation.

Educational satellite teleconferences have become a powerful tool for information dissemination. With the lowering costs of satellite receiving equipment and the increase in the number of programs receivable, satellite dishes may become a common a fixture in schools just as television and computers. The National Aeronautics and Space Administration has done much to promote educational applications of satellite technology. By increasing its number of offerings and increasing time devoted to activity demonstrations, NASA can do much to improve the effectiveness of its satellite teleconference for assisting teachers in their work. Results from the additional research recommended above could do much to enhance the growing reputation of educational satellite teleconferences as an effective alternative to face-to-face programs.

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APPENDICES

APPENDIX A

NASA TELECONFERENCE FLYER

NASA

National Aeronautics and Space Administration

Education Satellite Videoconference Series 1988-89

Announcement

For Elementary & Secondary school faculty
in all subject areas

SERIES THEME: ADVANCED TECHNOLOGIES
for aerospace transportation, piloted and unpiloted space exploration, and the classroom

Four one hour videoconferences will be delivered via satellite featuring program briefings by NASA project personnel & educational activities presented by specialists in aerospace education

Highlights
- Publications & other materials for teacher-participants
- Toll-free telephone interaction with speakers
- Current presentations from NASA project personnel
- No cost
- Opportunity for staff development
- Videotaping for later staff development use is encouraged

Moderator William Nixon, Head of the NASA Educational Technology Office

School Requirements C-band satellite receiving antenna tuned to Westar IV (or alternative arrangements to receive the satellite signal) Teacher release time Long distance phone line for interaction (optional)

Registration/Receiving Sites Schools and other educational service units are encouraged to complete the attached form to register as a receiving site Registration ensures that announcements and publications are received at the school Videoconferences are most successful when sponsored by a school with a coordinator to make local arrangements, greet participants, distribute materials, and , where possible, arrange for "wrap-around" conferences and related activities

Satellite. Westar IV (99° W)

Time		
	Eastern	2 30-3 30 pm
	Central	1 30-2 30 pm
	Mountain	12 30-1 30 pm
	Pacific	11 30-12 30 pm

Aerospace Education
Services Project,
Department of Aviation
and Space Education
Oklahoma State Universty
300 North Cordell
Stillwater, Oklahoma 74078-0422

Videoconference Guide

AERONAUTICS.....September 28, 1988
Aeronautics will discuss NASA's role in aeronautics research such as the National Aerospace Plane, advanced vehicle and materials technology, noise reduction, and wind tunnel testing Featured will be NASA's Langley Research Center and Roy Harris, Langley's Director for Aeronautics Norman Poff, an educational specialist in aeronautics will describe and demonstrate activities which can be applied to the classroom

LIVING IN SPACE.....November 15, 1988
Living in Space will investigate the human challenge of living and working in space for extended periods Topics will include space suits, food preparation, and human factors research Barbara Morgan, Teacher in Space designate, and the NASA Johnson Space Center will be featured John Hartsfield, an aerospace education specialist and author of a handbook of classroom activities related to the featured topic, will share some of his teaching ideas with the audience

FUTURE EXPLORATION.....January 24, 1989
NASA's concepts and plans for the long range exploration of space will be featured in *Future Exploration.* Alan Ladwig from the NASA Headquarters Office of Space Exploration will explain some of these advanced concepts Also featured will be NASA's Lewis Research Center Among the concepts to be discussed will be lunar bases, Mars outposts, and enabling technologies Dale Bremmer will demonstrate how some of these advanced technologies and concepts can be applied in the classroom

TECHNOLOGY & YOUR CLASSROOM.....March 21, 1989
Technology and Your Classroom will discuss new applications of NASA's aerospace research to industry and classrooms Featured will be the NASA Ames Research Center and its new supercomputer the Numerical Aerodynamic Simulator Special attention will be given to technologies for education such as computers, videodiscs, computer networks, simulations, and communication satellites Malcom Phelps, an aerospace and educational technology specialist, will demonstrate how these advanced information and communication technologies can be utilized in the classroom

Production

The 1988-1989 NASA Education Satellite Videoconference series is produced for NASA's Educational Affairs Division by the NASA Educational Technology Office and the Aerospace Education Services project, Oklahoma State University, Dr Kenneth E Wiggins, Director The videoconferences are produced with the assistance of the Oklahoma State University Educational Television Service

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To register as a NASA Education Satellite Videoconference site, please complete the form below and send to Aerospace Education Services Project, Oklahoma State University, 300 North Cordell, Stillwater, OK 74078-0422

School: _____
Coordinator: _____
Address: _____
City, State, Zip: _____
Phone: _____

Check each conference for which you are registering:

AERONAUTICS _____ *LIVING IN SPACE* _____
FUTURE EXPLORATION _____ *TECHNOLOGY AND YOUR CLASSROOM* _____
Estimate number of faculty participating per confernce: _____
Estimate number of faculty participating live: _____ on tape: _____

APPENDIX B

TEACHER PARTICIPANT SURVEY

NASA EDUCATION SATELLITE VIDEOCONFERENCES

TEACHER PARTICIPANT SURVEY

Instructions: This survey will help the NASA Educational Technology Branch evaluate its videoconference series and plan future conferences. Please respond to the questions by circling the most appropriate answer. At the end of this survey is a place for you to write your name, address, and telephone number. (Optional) With your permission, we would like to contact you by telephone for a short interview (5 to 10 minutes) to seek your opinion on a number of issues related to NASA Videoconferences. Your cooperation is greatly appreciated. Thank you.

What grade level(s) do you teach? (Circle any that apply)

a. elementary b. secondary c. college

What subject(s) do you teach?

_____

How did you view today's program titled *Future Exploration*? (Circle one)

a. live b. tape

Do you plan to participate in future NASA Videoconferences? (Circle one)

a. Yes b. No c. Unsure

Please rank the following elements of NASA Education Videoconferences in order of importance to you. (1 = Most Important, 5 = Least Important)

a. ____ information on current NASA projects (e g., Aeronautics, Living In Space)
b. ____ educational activities for the classroom
c. ____ announcements of NASA educational products and services
d. ____ ability to interact with the presenters (e g , question & answer)
e. ____ receipt of NASA educational materials after the conference (e.g., publications)

The subject matter of *Future Exploration* was relevant to me. (Circle one)

Strongly Agree Agree Neutral Disagree Strongly Disagree

***Future Exploration* was an effective staff development program for me.** (Circle one)

Strongly Agree Agree Neutral Disagree Strongly Disagree

I will be able to use the content of *Future Exploration* in my classroom.

Strongly Agree Agree Neutral Disagree Strongly Disagree

NAME: _____ SCHOOL: _____
ADDRESS: _____
CITY: _____ STATE: _____ ZIP: _____
Telephone number and preferred time of **day or night** we can reach you to discuss your opinions further.
TELEPHONE NUMBER: (____)_____
TIME OF DAY: _____

Please return this questionnaire in the enclosed postage-paid envelope as soon as possible. Thank you.

(Reverse Side)

NASA/AESP
Oklahoma State University
300 North Cordell
Stillwater, OK 74078

NASA/AESP; Videoconference Series
Oklahoma State University
300 North Cordell
Stillwater, OK 74078-0422

APPENDIX C

SURVEY FOLLOW-UP INTERVIEW FORM

SURVEY FOLLOW-UP INTERVIEW FORM

Sample Number: _____
Teacher Name:_____
Telephone Number: (_____)_____
Time of Day:_____
School Name: _____
Grade Levels Taught: _____
Subjects (s) Taught:
_____

Opening Remarks:

Hello: My name is (N). I am calling on behalf of the National Aeronautics and Space Administration. Several weeks ago, you participated in a live NASA videoconference on the topic of future exploration. I am calling in response to the evaluation form you completed at the conclusion of the program. I would like to request a few minutes of your time to ask you a few questions and solicit your ideas about the program you saw and about NASA videoconferences in general. Your assistance will be of great service to us in planning of future videoconferences. Your answers will be kept confidential. Results of this survey will be discussed during a future NASA videoconference.

To refresh your memory of the program, Alan Ladwig of NASA Headquarters described NASA plans for future lunar and Mars exploration and Dale Bremmer, of Oklahoma State University demonstrated a number of classroom activities.

We are interested in finding out if and how you made use of the program content of *Future Explorations* in the classes you teach.

1. **Did you make use of the content presented during the *Future Explorations* videoconference in the course(s) you teach?**

YES NO
(If No, go to #6)

2. **Did you discuss the program content with your students?**

YES NO
(If yes, ask for examples of how the program content was used for discussion.)

3. **Did you use any of the classroom activities presented in *Future Explorations* with your students in their original form or in a form modified by you?**

YES NO
(If YES, ask for a description of what was done.)

4. **Did you give your students any special assignments, such as research projects, based on the program content?**

YES NO
(If YES, ask for a description of what was done?)

5. Did you make use of the content of *Future Explorations* in other ways with your students or in any other professional setting?

YES NO
(If YES, ask for a description of what was done)

6. Why wasn't the content of the *Future Explorations* videoconference of use to you in your teaching? (Use this question only if the answer to #1 was NO.)

7. Do you have any suggestions for ways of making NASA videoconferences of greater use to you?

YES NO
(If YES, ask for the suggestions.)

Terminate The Interview

Thank the participant for his or her time.
Remind the participant that the next videoconference is March 21,1989.

APPENDIX D

ACTUAL CONTENT USE

INSTANCES OF ACTUAL USE OF NASA EDUCATIONAL SATELLITE TELECONFERENCE PROGRAM CONTENT

(Response numbers in this and the following section match with individual teachers.)

1. Discussed program with students. Plan to use videotape and activities next year.

2. Talked about careers with my Young Astronaut chapter. I tried several activities. I plan to bring in speakers

3. I plan to use some of the activities when our rocket unit comes up. I also plan to have worksheets.

4. I created a lesson on the program and tied into the videotape. I covered biodomes, vehicles, etc. I plan to use the tape with my astronomy club and science students. We discussed careers. I had the students draw their conception of a space lab that would accommodate a person for three years. Some really creative ideas came from it.

5. I plan to make use of the material later in spring during a space exploration unit. I plan to discuss the video tape and will use it as an introduction for discussion about the exploration of Mars. I will also use a worksheet provided by the site coordinator.

6. I may use the program content next year.

7. I tried the straw activity.

8. I have used the content as background information to talk about Mars exploration.

9. We began three days of discussion on the necessities of Mars exploration and the question of non-astronaut participation in space flight. We followed with team projects on planning for Mars exploration. Team members made reports.

10. We have used the experiments. The information was useful for our aerospace education specialists that visit 185 schools in the Richmond, VA area.

11. Talked about Lewis Research Center programs relating to space station and future exploration.

12. I will be doing a unit on rocketry and will cover some of the program content then. I will be making assignments.

13. I will discuss the content with my students.

14. I try to take as many things as possible that apply to the subject matter I teach...space exploration, planets, etc.

15. No, not yet. I probably will. I haven't given it much thought.

16. I plan to use the program later. I will use it in activities, discussions and assignments.

17. I especially liked talking with my students about landing a spacecraft on Phobos. A week later, the Weekly Reader had an article about landing on Phobos. I liked being able to talk about it before the students read about. We entered a space station poster contest from the Lewis Research Center.

18. I used the content in discussions on the nature of science. I also reported on NASA's plans for exploration.

19. We discussed the future of space exploration.

20. The program worked out nicely for me because I was just starting a space science unit with my students. I use publications given out for in-class assignments.

21. We spent the next day in discussion on the things I saw and heard. We are scheduled to do planetary exploration next year.

Therefore I did not try to do any of the the other things presented.

22. I did not use the program with my students.

23. I tried some of the activities in science club. There is not enough time in my regular classes to try them.

24. I tried the activity with the straws but it didn't work.

25. I have not been able to fit it in yet with my classes but have used the program with fellow faculty members. We are studying chemistry right now.

26. We discussed how it would be to live in space.

27. I used with staff development. I told other teachers about opportunities available. I am a library media person.

28. I haven't used the program. It has very little application to me. I teach chemistry and we are working on isotopes at the moment. Next year we will be moving to a new school and I will be in charge of the senior science seminar. I expect to make good use of the content with independent student research.

29. I tried the activity with the paper tube.

30. We talked a little about the exploration of Mar and what the Soviets have done. We tried the gyroscope activities.

31. I am an aerospace educator. I have seen it all before. There was nothing new for me. I taped the programs and distributed them to teachers.

32. I came back the next day and was really hyped up and shared what I learned with the kids. We did research projects and the children brought them in today...space stations, space labs, satellites, etc.

33. I have been using the activities like the gyro platform because it relates to articulated rotor systems of helicopters. The

hammer and hinge activity relates to center of gravity in airplanes. We show the video tapes.

34. We have not used the program. We do a little unit on the solar system and will probably use a tape of the program. The program didn't coordinate with our schedule.

35. Discussed program with the students. We had some kids in after school and they saw the activities. They were really taken with the hammer activity.

36. I will be using the program content at a conference on Saturday..."Expanding Your Horizons"...for girls to encourage them to enter scientific careers.

37. We had the 7th graders watch it live. We showed the videotapes to some classes. Some of the students were fascinated. Others were somewhat interested. I have passed the information on to other staff members. We are really very impressed with the materials and SpaceLink.

38. We have not made use of the program yet. We will use it later. We will cover living in space and where America will be in the future.

39. I do not teach myself but make the materials and information available to teachers.

40. I am a librarian and just make the material available to those who need it.

41. We have tracked satellites in an all-school project.

42. We have tried the activities. I have assigned projects like planning how it would be to travel into space and build a space station. We are going to build a rocket.

43. I plan to use it in future classes.

44. I haven't had time to use the program.

45. The activities went very well.

46. I haven't used it yet but we will discuss the material and assign creative writing projects.

47. I shared the experience with my students. That was neat. They didn't know this kind of communication was available. I asked them what kinds of questions I should have asked. I plan to do more in the fall. We already passed the unit where this is covered.

48. I have not used it yet. We won't be getting into that unit until after Easter. I can't remember offhand what I will use but I took many notes and I always try to use new materials in my lessons.

49. I took all my students to see the teleconference. The activities were really excellent. It was great for my students to see them being done. We were doing a unit on the future and this fit in perfectly. I plan to use tapes of all the programs next year.

50. I did some of the activities. I was a NEWEST teacher last year and was familiar with some of them. I will make use of the program with my Young Astronaut chapter. I showed the tape.

51. I teach first grade. The program was knowledgeable for me.

52. I haven't used it yet but plan to discuss it and will use the tapes when we get into that subject matter.

53. I spoke to my students about it somewhat. This is my first experience and I would like more information.

54. I plan to use it when we get to astronomy. I will show the tape and ask questions.

55. I plan to use it with our Young Astronauts. I plan to use a tape. We already finished our astronomy unit.

56. This is not a part of our curriculum yet. I will be laying out plans for later.

57. We showed a tape of the program to my students. We also did Young Astronaut worksheets.

58. I led discussions with the brighter kids. We talked about careers and why math and science is so important. We played a commercial game about setting up a Moon base.

59. I plan to use the activities as a group. I am just beginning to start on a space unit.

60. I am a reading teacher and I don't think it would apply to what I do.

61. I will use the program in the future.

62. We had 40 elementary children and 10 high school children watch the program.

63. We are coming up on a space science unit but I don't know if I am going to use the material yet.

64. We were studying aerospace education at the time. I told them about the program. We are doing a project on going to Mars. We did some air pressure activities. We also made food trays from the last program.

65. I plan to use the paper tube demonstration. I will probably show the video (Beyond Earth's Boundaries) to my students.

66. I think I will use the material but I haven't given it much thought how I will do it.

67. I am not teaching now. I am setting up a new school but would have used the materials if I were teaching.

68. I had the students work on space station designs.

69. I don't remember filling out the survey form or seeing the videoconference.

70. I don't teach science this year.

71. I will probably use the materials this spring with the high school students. I will use the materials with younger children next year. I teach gifted and talented for grades 1-12.

72. I used the activities as motivational material with low track students. Some children did extra credit assignments.

73. We plan to use some of the activities when we get to a unit on kites and aerodynamics.

74. We pan to do a space unit and use the activities and a tape of the program.

75. We will be teaching science next year and I will use it then. I am teaching language arts now.

76. We have used some of the demonstrations with our Earth Science unit.

77. I had a unit on space and showed part of the video tape and talked about what NASA is doing in space stations.

78. I have used some of the information in the Young Astronauts club. I will make assignments a little later about what life would be like on Mars.

79. In science class we discussed how it would be to live in space and about the experiments the astronauts do. We discussed how toys would work in space.

80. I did discuss some of the program with my students individually.

81. We haven't gotten to the topic yet. I don't know what I will be doing then. I will just wing it.

82. We do a lot with aerospace concepts. We study future missions. I haven't gotten into the activities yet but I plan to. I am writing a lab unit that will incorporate the activities.

83. We will be expanding our curriculum into aerospace science next year. I will use the materials then.

84. I am just starting a unit now and I may use some of the materials then.

85. I will use some of it I think. We are doing a unit on rocketry and I think this has something to do with the conference...I think.

86. I gave an assignment on Mars.

87. I teach physical education. I will be teaching at space camp this summer and will use it then. I have not thought about how I will use it.

88. We are using the materials for discussion in astronomy.

89. I discussed the future plans of NASA with my class. We tried the paper towel roll experiment. I made assignments concerning flight differences in pressure.

90. I teach aerospace education at a consortium of schools. I am always doing units on rocketry and planetary exploration. I try to explain what is happening at present and what our future goals are. I am developing units on future exploration for next year.

91. We passed the subject before I could use it. I will probably use the demonstrations the next time.

92. We haven't gotten to an astronomy unit yet. We will next week. Its possible that I will go through my notes.

93. I am a team leader for a bunch of teachers. I teach electronics. I have discussed the content with my students. I try to prepare them for the job world and it is important to see the range of opportunities open to them. My students are not interested in the activities. They have more sophisticated interests. I have shown the tapes to my classes. Some of my adult students have borrowed the tapes to use with their scout groups.

94. When the topic matches what we are doing, I discuss it with the students. I have shown tapes to the students.

95. I tried the hammer activity.

96. We will be starting a unit on the solar system in a month. I plan to discuss the history and future of the Moon and its potential. I will also cover space stations and other possibilities.

97. We watched it together and talked about it. We have a science fair going on now and some of the students come in during lunch hour to watch it as research for their projects. I show the tape with some of the slower students a couple of times to give them extra practice.

98. I haven't reached the Earth Science unit on astronomy yet. I did mention the program. I may use some of the activities.

99. We are just getting into a unit where I will use the content. I will use video tapes and discussion. I have tried the paper towel roll activity.

100. At the end of the year we will be doing our space unit. I will do some of the experiments.

101. I sometimes use tapes with the students. Mostly, we have been doing research on the future. One of the tools we use are oral presentations and experiments.

102. We will be starting a unit in a few weeks. I do simulations with my students. I will use the program content to spur their imaginations.

103. We talked about careers and the relation of technology and education. We used the employment trends graph. I tried to show them that there is a need for people to go into technologic fields. I will be showing the activities on videotape.

APPENDIX E

IMPROVEMENT SUGGESTIONS

TEACHER SUGGESTIONS FOR IMPROVING NASA EDUCATIONAL SATELLITE TELECONFERENCES

(Response numbers in this and the previous section match with individual teachers.)

1. Level too high for elementary students. Too technical. Graphics were great. Suggest two different programs...one for elementary and one for high school.

2. More time for activity demonstrations. Information on careers was very helpful. The next program will fall during spring break. I will record it.

3. I would like more examples of activity demonstrations. Lengthen the demonstration time and shorten other program parts appropriately. The next program falls during our spring break.

4. I like things just the way they are. The program length is just right. I have enjoyed the programs immensely.

5. I teach 5th grade and use the material more for background. A lot of the material is over the heads of our kids. The program gave me new background material that I can scale down for the kids.

6. It would be helpful to have materials on hand instead of having to request them later.

7. I like the activities and would appreciate printed copies of them.

8. I think the activities are really neat. The programs are over the heads of the elementary children. Lower the level to make

it easier to relate the information to the children. I really like the experiments. I enjoy the content. I have copies of the tapes and use parts of them with the children. Lower the terminology level.

9. We had a pre-program event with a Teacher-in-Space candidate. We would have liked to have had more experts on hand to answer questions. The program is great the way it is. Students are enthusiastic about it.

10. The biggest concern of all the teachers in attendance is the lack of materials for distribution. Some wanted to use the materials shown the next week and there wasn't time to write away for them. Besides, teachers don't always get around to writing. We would like to put a publication in everybody's hand. (respondent was site coordinator)

11. Program content fits into work we will be doing later on. Because I teach physics, I would like things to be more technical.

12. The demonstrations help a lot. I would like to see more demonstrations. It would really help to have a lesson plan book available.

13. I prefer teleconferences to NASA literature because I can get information in a short time instead of having to spend a lot of time reading. I like the multimedia approach involving several speakers and different scenes like you had with the space station program last year. I liked hearing where questions come from rather than having the moderator reading them. Time is a problem. It would be better for the program to air later. It would be better not to hold programs during spring break.

14. No suggestions for improvement. I think it is pretty good.

15. No, I really can't think of any improvements.

16. No suggestions for improvements.

17. The activities were great but they went by too quickly. I would really like copies of the activities. I forgot many of the

activities because they went by too quickly. I would like to see more NASA posters.

18. I think the graphics were excellent. The program was too long for my students to see. As a professional development program, it was just excellent...exceptional. All of our teachers see it.

19. The satellite speakers helped clear up confusing points from earlier programs. (referring to earlier presentations at LeRC) The satellite program was well-done and interesting.

20. I could not think of any improvements. I had to leave only 20 minutes into the program.

21. I thought it was very good. I was impressed. This was my first experience with it.

22. The topic didn't relate to what I do. I teach physics and chemistry. I would like to see a program on fuels and handling. I was very impressed. Very interesting.

23. I would like a real good space map by satellite. I would like to see a program on remote sensing and have data to pass out.

24. I am mainly interested in the activities. It would be great to receive copies of them. Leave more time for questions.

25. Provide some written information about the activities.

26. The first part of the program was over the children's heads. The program about space food and space suits was great for younger children but this program was harder to adapt to younger children. Should have someone interpret terms.

27. We had trouble with the audio channel. I didn't care for the person who read his report. Too long. The vocabulary was too high for children. I did have one student watch the program. The student is working on a science fair project. It was good for the students to see experts in the field talking about what they do. Continue the demonstrations. The video tapes at the end are very good.

28. I thought it worked quite well for me. If I were to show it to students, I would like the graphics to move a bit faster during the speaker's presentations. Be quicker with the visuals.

29. I liked the background information for the teachers and the activities. It is really great. I enjoy them.

30. It is inconvenient to see the programs. I have to find a substitute and then go to another school to watch the program. The kids don't care much about the exploration of Mars. Its too vague. I really like the hands-on activities. I find it real rewarding to find out what NASA is doing.

31. I would like to have publications before the program. Teachers complain that if they aren't given copies on the spot they may never see it again. I would like the broadcast done either after school or on weekends. I would like some pizazz...something more than talking heads. NASA should be able to do something more interesting and innovative than these conferences.

32. This was the first teleconference I attended. I was quite satisfied. There was not enough time for questions. I think it was great to hear from scientists and engineers. I would like to hear more from teachers.

33. The first part is really interesting but not much use to me because I teach aircraft maintenance. The programs are pretty good. People don't realize how much physics relates to their everyday lives. I do find it irritating when people call in and ask questions not related to the program topic.

34. Off hand, I can't think of any improvements except better coordination of written handout materials to the program topic.

35. No ideas for improvement.

36. It has been pretty useful as it is. We generally take our science teachers to the viewing site to focus on NASA. It is a good time to get away and concentrate on science education.

37. The program was sort of fast and furious and not geared for children. We would like a program for children. I think it is fabulous. The information was wonderful. I am really talking

up the program to other teachers. We were especially thrilled to get to ask a question on the air.

38. Show very current things that can be used and shown in the classroom.

39. I have had positive feedback from my teachers. Open the sessions to children as well. I really enjoy the videoconferences.

40. Make more time available for phone calls.

41. I think it is really great. The kids need to have this kind of information and to see that these people are just like them. It helps them set goals for the future.

42. I would like to know what to expect from the program so that I can prepare my classes for it.

43. Split the programs into different grade levels such as elementary, middle, and high school. It might be more effective that way.

44. I would like to have copies of the activities in my hands when I leave the conference.

45. The program content wasn't related to my class. The speakers should be more conversational. The content was good. The speakers should be more animated. Better use of visuals.

46. The program could have been a bit longer. The activities were fine. It would help to have a synopsis of what the speakers were going to talk about to better prepare us for what was coming. This was my first teleconference. I enjoyed it.

47. My only criticism was there wasn't enough time for questions. Only three questions were asked. It was my idea that teleconferences should be interactive. Put the names of the persons we can ask questions on the screen. It is nice to ask questions to the person by name.

48. At the end of the program there were a number of demos that I thought were fascinating. I picked up a few that I hadn't known of. I would appreciate lesson plans.

49. The tape at the end was excellent. The content was a bit high for my students. I do realize the programs are designed for teachers. I would like more of a written preview of what will take place. I am really supportive and hope you do them for many years.

50. I thought it was great that we heard about some things that appeared in the paper two weeks later. Certain people have idiosyncratic speech habits. I would like more demos. Don't take time to remind people about upcoming events because we have heard it several times...waste of time. The next program is during spring break. The program was like an encyclopedia...say that again? It would be helpful to have program details a bit earlier. It has come too late to make good arrangements.

51. It would help if you could divide the activities into different levels. We do have a space unit in first grade. I would like to keep up on current events.

52. It would be nice to have some of the material ahead of time so that we can be more alert as to what to expect. It was exciting that we were able to communicate with NASA live.

53. I would love to have tapes to use. I was amazed at the low turnout at our site. It was impossible to get through for questions. Two-way conversation was great. I would like to have big visuals for the classroom. The teleconferences help me bring some content into my class.

54. I enjoyed it immensely. The thing that struck me was how you can get from the drawing board into the air without it becoming obsolete before it does.

55. We had a large viewing audience and had lots of questions. We wanted to know about the current status of the teacher in space. We would like advertisements of programs.

56. This was my first teleconference and I was thoroughly fascinated by it. I enjoyed it.

57. I would like a program for younger students. My students are interested but the level was too high for them. Some loved it.

58. The program was dull at the beginning. Too much chatting...talking heads. I liked the demonstrations. I would like more of those. Teachers are good at assimilating information but not always good at finding ways to approach that information with the children. I would appreciate more help in this area.

59. More history on space background for lower levels.

60. If for elementary, the only part that is applicable was the last 9 minutes and the activities. We should make more things that would apply to the lower grade levels.

61. I would like more time for each person to expand on what they have to say. Adults have longer attention spans than children so you can lengthen it.

62. The programs have incredible potential for use solely by students. The last program was too high for elementary students. The kids really got excited. We got on the chow for a couple of questions.

63. Orient the program more to junior high school level than adults. I may use the experiments but I was unable to take it all down fast enough to get the details. I would like printed handout materials.

64. I would have liked to have had handouts to use at the time. I really enjoy the programs. They are very good and of help to me.

65. I can't think of any ways to improve the programs. I really like the science demonstrations and the tapes.

66. I don't have any ideas how to improve the programs.

67. I would have liked more information on the electromagnetic mail system. There wasn't enough time for it.

68. I would like more printed materials, videos, slides, and posters.

69. It would be nice to have written instructions on how to do the demonstrations. Otherwise, it was real informative.

70. More direct relation to the classroom. More handouts for the classroom.

71. I attended the LeRc conference. I debate each time whether to spend the time away from the district. The teleconference part brings me back each time.

72. I would prefer the speakers not to read their notes. It would be better for the students to see the speakers in a less formal, more natural setting.

73. The planned discussion was not good for our students. It moved too slowly. It is better to demonstrate as you talk about something. We thought it was funny that NASA was having difficulty with its telephone interactions. Makes you wonder about the people in charge.

74. The call-in question period is too short. I am enjoying the programs. I think you are doing a good job.

75. Perhaps have interactive video with input from the audience. The language was a little over the heads of the students.

76. By and large, our faculty is disillusioned by the programs. It was a big waste of time. The main speaker read from a publication that was distributed to us. We read along with it. I am not sure that I will attend another. It would be much better for the speaker to be interviewed so that we could get some insights into the program topic rather than just the printed line. The question period was too short to be useful. It was practically over before we got a line out of our building. It would be very helpful to have printed materials, especially on the excellent demonstrations. I think it would have saved everyone time and money just to mail out the publication. If I tried to put on a similar program with 8 and 9th. graders, I

wouldn't last half as long before I would loose the class. If my supervisor were there, I might also loose my job.

77. Improve the way information is disseminated from the receiving site to the schools. Make tapes and information readily available.

78. It is really good as teachers to be able to go back to the classrooms and tell the students what the future will be like. I would like more information about the Space Shuttle.

79. We did not have printed materials prior to the videoconference. More hands-on things. Would like to do some of the activities at the videoconference site.

80. It would be nice if there were some way to inform teachers about the programs in advance. I just heard about it a few days before. I had to watch it during my classes and saw only parts of it.

81. The question time is a waste. Spend more time with NASA information. It wastes a lot of precious time. I especially enjoy hands-on experiments. That gentlemen that presented them was just marvelous. I like ideas for inexpensive and easy activities. Keeps the program going.

82. Is there a possibility that the activities can be printed up and distributed prior to the teleconference. The speaker was very good but rushed. There wasn't enough time to write down the activities. If we can't get them all down, it isn't as likely that we will use them.

83. I was very impressed. This was the first time I have had contact with NASA. It was better than I had expected. I would like more time for activities. The gentlemen that presented them was outstanding. Keep them simple and inexpensive. Our budget is busted.

84. I would like to have printed and video materials for use with my kids. I would like to see programs on remote sensing and lunar and planetary studies with an emphasis on geology.

85. I can think of no way to improve it. It is great.

86. The high point of the videoconference is the demonstrations. Keeping up to date on space programs is valuable. Panel discussion is good. Keep doing the demonstrations with things readily available.

87. It would be good if the level of the program could be lowered so that kids could watch it and not hear it second hand.

88. Have more time for questions. On the whole, I've really enjoyed the conference.

89. I have no suggestions.

90. I find sometimes that it is geared more towards middle and high school. When you are working with younger ones, it is important to have more concrete things. More ideas of how to apply concepts with children.

91. I liked the demonstrations. Simple and inexpensive demonstrations are very important. The students need things to see and do. I would like the materials before hand and follow-up materials on how we can use the concepts with the students.

92. No ideas. This is my first one.

93. I would like to have the level raised. I know this wouldn't be popular with the elementary teachers. Perhaps the program can become more complicated on a rotating basis. My students are interested in stealth, reentry, technology, ceramics, skins, attitude, and communication. I would like a program on spinoffs. I try to show my students that they are capable of working in technologic fields. We need help from NASA in this. The next program takes place during spring break.

94. I would like to see the programs become more manipulative. The students need activities in order to grasp the concepts. The content is not over their heads all the time. I appreciate being a part of the teleconferences. It would be helpful to have more materials in order to prepare for the program.

95. Basically, the program works for me. I have been teaching physical science for 5 years and am just getting back into Earth Science. I find the programs are good for updating my background.

96. I would really like to find some way to get tapes of the programs.

97. Since I am new to this, I can't think of any improvements.

98. The question period was too short. We only had time for two or three questions. Answering questions was confusing at times. The three panelists bounced questions among themselves. It was awkward. We were not sure who was going to answer. Time was lost deciding.

99. There were communication problems with the question period. A lot of time was wasted when questioners couldn't be heard. Not enough questions were answered. I enjoy the programs.

100. Getting information regularly is good. I don't have any suggestions for improvement...as long as we are updated. That helps a lot.

101. I would like to see more practical applications and experiments. I really enjoy it and I think our local NASA person (Gail Bresslauer) is doing an excellent job. We have got to do more preparing of students for the future. I like applying technology.

102. We need more accessibility to viewing sites in our area.

103. The teleconference was new to me. It was really a nice experience for me.

VITA

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