A MULTI-LEVEL FOLLOW-UP STUDY OF THE OKLAHOMA STATE UNIVERSITY'S ARTS AND SCIENCES TELECONFERENCING SERVICE (ASTS) COURSES IN MATHEMATICS

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CHAPTER I

INTRODUCTION

This thesis is based on a multi-level follow-up study of the courses in mathematics offered by Oklahoma State University's Arts and Sciences Teleconferencing Service (ASTS). The study included former students, teaching partners, and administrators of participating schools in ASTS' *AP Calculus By Satellite* and *Trigonometry/Analytic Geometry By Satellite*. The data collection method used in the study was a survey.

Besides its theoretical contributions, this study provides information that can be used by ASTS for academic and administrative purposes. Such information consists of opinions about several aspects of the courses, suggestions to improve the courses, and a demographic description of former participants in the courses.

Background

The Arts and Sciences Teleconferencing Service (ASTS) is an administrative unit of the College of Arts and Sciences of Oklahoma State University, responsible for the management of a satellite-based distance learning program aimed at high school students all across the United States. Since 1985, ASTS has provided courses in foreign languages, mathematics, science, economics, government and reading.

During the school year 1991-1992, ASTS offered eleven different courses, received by more than 400 schools in 34 states. In order to participate in the program, the schools are required to install a satellite C-band downlink, a large TV monitor, and a telephone hook-up, and in some cases, to make microcomputers available to students in order for them to run educational software related to a particular course.

Two advanced courses in mathematics are offered by ASTS: AP Calculus By Satellite, and Trigonometry/Analytic Geometry By Satellite. *AP Calculus* (APC) is a full-year college-level introductory course in calculus. The course is intended to prepare advanced high school mathematics students to perform satisfactorily on college-level tests, such as the *Advanced Placement Calculus AB* exam and the *College Level Equivalency Program.*

The course is taught by Dr. Jim Choike, Professor of Mathematics at Oklahoma State University. Each participating school provides a certified mathematics teacher who acts as a *teaching partner* to Dr. Choike. The course is broadcast live via satellite from Stillwater, OK, in three 45-minute sessions per week. Students have a lecture guide and workbook that describes in detail the program of the course, including homework assignments.

Trigonometry/Analytic Geometry (TAG) is a course that covers trigonometry in the fall semester, and analytic geometry in the spring semester. The course is taught by Dr. John Jobe, Professor of Mathematics at Oklahoma State University, in association with teaching partners provided by each participating school. Each student works with a lecture guide throughout the course, and like AP Calculus, this course is also broadcast live three times a week.

In both courses, as in any ASTS course, the students may interact with the OSU professors and their staff, either during the lecture time or during office hours, using a toll-free telephone hotline. This interaction capability is used by the students to ask questions regarding the material and to obtain information about the course in general.

Table 1 includes statistical information on both courses since their inception in 1987. "Number of states" is the number of different states from which at least one school participated during the academic year. "Number of sites" is the total number of schools participating in the course during the school year. "Return rate" is the percentage of schools in a given year which had also participated the previous year.

TABLE 1

ASTS MATHEMATICS COURSES STATISTICS

	1987-88	1988-89	1989-90	1990-91	1991-92	TOTAL
AP CALC.						
Num. of states	6	8	17	20	21	--
Num. of sites	12	9	38	63	45	167
Return rate	--	25.0	22.2	42.1	31.7	--
TRIG/A. GEO.						
Num. of states	7	6	8	3	9	--
Num. of sites	16	15	19	8	15	73
Return rate	--	25.0	26.7	15.8	25.0	--

Source: ASTS (1991).

AP Calculus has a larger number of participating schools, which come from a greater number of states, than Trigonometry/Analytic Geometry. Although the return rate for APC climbed to 42.1 percent in 1990, it fell to 31.7 in 1991, which means that about one-third of schools enrolled in 1991 had been also enrolled in 1990, while the remaining schools were newcomers, or schools that had participated before, but not in the immediately preceding year. Other than in 1990 when it dropped to 15.8 percent, the return rate for TAG has been about 25 percent.

According to Holt (1991) the development of an ASTS course requires $250,000 to $600,000, depending on several factors, such as the type of computer software used, if any, and the type of pre-production needed for the course. Once a course is on the air, each lecture session costs about $1,000 for production and transmission. Additionally, the cost of faculty and staff salaries must be covered by the program.

The Problem

Despite its relatively long experience as a distance education provider, prior to this study ASTS had conducted only a few research efforts, mainly for evaluative purposes. Holt (1991) reports, for example, the results of studies regarding German, AP Physics, AP Calculus, and AP American Government courses, apparently conducted with the purpose of measuring the effectiveness of the courses.

Each of these studies was based upon a different approach to effectiveness. The German and AP Physics study compared the American College Test (ACT) scores of high school seniors who took the courses against students who did not take them, finding that ASTS students achieved scores about 40 percent higher than non-ASTS students. The AP Calculus study traced the results of students taking the AP Calculus AB examination in 1989-1990, finding that 67 percent of them obtained a score of 3 or higher. The AP American Government study analyzed the teaching partners' opinions regarding changes in students' attitude as a result of the course.

Although useful as partial measures of success, such approaches to effectiveness in distance education seem --if individually viewed-- oddly limited, given the elusive nature of the "effectiveness" concept. That is why there is a need to conduct new studies that approach the measurement of effectiveness in a more comprehensive way.

The study reported in this thesis attempted to respond to such a need by including several indicators of success, by doing measurements at three levels --students, teaching partners and school administrators, and by delaying the measurement to a medium to long term --doing a follow-up study instead of studying current participants.

As indicated by Moore (1991), there is a shortage of research in distance education beyond the evaluative level. ASTS, for example, has not conducted any research project with this orientation. This study also responded to the need for theory-building research by including statistical analysis of relationships among variables that,

besides providing explanations for the observations, can set the theoretical basis for further research.

Finally, ASTS has not systematically collected demographic data about its participants. This study provides basic demographic information regarding the participants in ASTS mathematics courses.

Objectives Of The Study

In addition to collecting information that could be used to build a comprehensive measurement of effectiveness of ASTS mathematics courses, this study had two other main objectives: to identify the factors that are statistically related to the evaluation of ASTS mathematics courses by former participants, and to collect demographic data regarding the participants in ASTS mathematics courses.

Theoretical Framework

The field of distance education is so complex that there are many theoretical approaches that can be used for its study. For example, emphasis can be put on organizational issues (Mark 1991), learning styles and patterns (Campbell 1991; Broick 1991), course design and instruction (Dwyer 1991; Davis 1991; Chute, Balthazar and Poston 1991), or the mediated communication element of the process (Lane-Johnson 1989; Moore 1986; Garrison and Shale 1989), to cite just some of the multiple possibilities. However, for the purposes of this study the theoretical problem was narrowed to two dimensions: the problem of effectiveness, and the factors related to satisfaction.

The Problem Of Effectiveness

There is a tendency to measure the effectiveness of a distance education effort by comparing it to "conventional" education programs. According to this view of

effectiveness, distance education is effective if there is no difference in the results obtained by students participating in distance education programs and the results of students working in a "conventional" education environment. Following this line of thought, Threlkeld (qtd. in Holt 1991), for example, reports several studies that prove that distance education is as effective as conventional education.

This approach presumes that distance education could be a *perfect substitute* for conventional education, in a situation where students could choose between taking either a conventional or a distance education course. Thus, the emphasis is put on proving the lack of difference in results, since if both education methods are equally effective, either one can be used at a given moment, with the same type of results.

However, when this line of research finds that students participating in distance education obtain results as good as --or even better-- than those obtained by conventional students, it may be because distance education students are, in general, more motivated to learn, or are better students, or both. Then, the important factor may not be the nature of the education setting, but the personal characteristics of the students.

Another approach would be to recognize that, in general, distance education is used as an *alternative* to --not a perfect substitute for-- conventional education. The concept of "alternative" as used here is in opposition to "mainstream" and is similar to its use when sociologists talk about "alternative press" as a movement that fills a need for information and opinion not satisfied by the "mainstream press." The difference between this and the scenario described in the previous paragraph is that while a decision of choosing between substitutes implies that both options are available, an alternative is used when a conventional option is not available. Therefore, according to this view, the objective of distance education is not to compete against conventional education, but to close a gap created by differences in access to conventional education.

For example, if a high school has a group of students who want to take an advanced placement course, *and* the school has a certified teacher available to teach the

course, the administrator must decide whether to offer the course with that teacher, or to subscribe to a course offered by a distance education provider. However, if the school does not have a certified teacher available but *does have* a group of students who need the course, the administrator must choose between subscribing to a distance education program or not offering the course at all. As Choike and Jobe (1991) argue, for the students in such a school, the options are taking the course via satellite or not taking the course at all.

Since the first scenario may be uncommon --students choosing whether to take a conventional or a distance education course-- research testing, in a controlled environment, the "no-difference" approach to distance education may be a closed path. Instead, research measuring how well --and under what circumstances-- distance education works as an alternative to conventional education may help administrators to make decisions.

Thus, the relevant research question seems to be, for example, at the student level: Does distance education contribute to the further development of students, e.g. does it help them to prepare to attend college successfully? Although it may be impossible to prove that participating in an advanced distance education course was a factor in a high school graduate's decision to go to college, it may be illustrative to know whether former distance education students attend college, and with what degree of success.

At the teaching level, a question that should be answered is: For a high school teacher unqualified to teach an advanced mathematics course, does participating as a teaching partner in a distance education program contribute to training him/her to teach such an advanced course on his/her own?

At the school level, an important question would be: Does participating in a distance education program contribute to the development and strengthening of the curriculum, especially in areas such as advanced mathematics and advanced sciences?

These are only a few of the questions that may be answered in order to measure how well distance education works as an alternative to conventional education. None of these indicators can be seen --alone-- as a final evaluation. Instead, a collection of them may give an approximate measure of distance education effectiveness.

Factors Related To Satisfaction In Distance Education

The questions presented in the previous section contribute to an assessment of how well distance education works as an alternative to conventional education. However, another set of questions must be answered to explain under what circumstances distance education works satisfactorily. Two main types of questions may be asked: those related to demographic variables and those related to elements of a distance education situation.

In terms of demographic variables, it is important to know the composition of distance education participants. At the student level, variables such as age, gender, grade point average (GPA) and relative position with respect to their class may provide a description of the group. At the teaching partner level, relevant variables would be age, gender, years of teaching experience, and whether they are certified teachers. At the school level, the variables would be size of student body and the ratio of the number of students to each certified teacher.

If a distance education program seems to work --or not to work-- these variables help to identify the circumstances under which this happens. Moreover, demographic variables may help to explain differences in some of the variables used to measure effectiveness.

The second set of questions focused on satisfaction with the elements of a distance education program, such as the use of a technical medium, i.e. television, audio, computers, etc.; the presence of a teaching partner --sometimes called monitor, assistant, facilitator, etc.;-- the use of written materials that guide students throughout the course; and the remote access to the teacher and the institution providing the educational service.

Each of these elements may be related to the satisfaction with the program. However, it is possible that the relation of each one to the overall evaluation of the program may vary in degree. Thus, besides knowing the demographic pattern of participants in a distance education program, it is important to measure how strongly each of several elements of the program is related to the overall evaluation.

Scope And Limitations Of The Study

To some extent, this study had a wide coverage, since it worked at three levels of aggregation --student, teaching partner and school administrator; it measured variables through time --it was a follow-up study; and it included two distance education courses. However, the study had limitations.

First, it referred exclusively to advanced mathematics courses. This is a limitation because it may be different to teach advanced, highly motivated students at a distance, who *need* to take an advanced mathematics course in order to prepare for college, than to teach an average, heterogeneous group of basic mathematics, in which some students may be intrinsically motivated to take the course, while some others --maybe the majority-- require external motivation.

Second, this study referred to high school students who cannot be considered adult students. While many distance education programs are aimed at adult learners, ASTS works with adolescents. Consequently, the results of this study may not be generalizable to other types of distance education programs.

Third, the study referred only to mathematics courses and the results may not be generalizable to other ASTS high school courses in areas such as languages, basic reading, economics, sciences and government.

And fourth, despite the seriousness with which it was designed and conducted, the study had methodological limitations that will be discussed in Chapter III.

Outline Of The Thesis

The remainder of this thesis consists of four chapters. Chapter II is a review of literature related to distance education, education research, and research methodology. Chapter III describes in detail the methodology used in this study, including the research design, selection of subjects, research instruments, data processing and analysis, and methodological assumptions.

Chapter IV presents, interprets and discusses the findings in terms of the hypotheses proposed in the previous chapter. Chapter V summarizes the study, offers conclusions and recommendations, and suggests avenues for further research in the field.

CHAPTER II

REVIEW OF THE LITERATURE

According to Moore, "The successes in American practice (of distance education) have not been equaled by the extent or quality of its research or even its descriptive literature" (1991, xii). However, Coldeway's (1991) analysis of research in the field of distance education concludes that in recent years, "the development of research has grown, . . . (as well as) a discussion of appropriate method, philosophy of approach to research and epistemology" (p. 386).

This chapter is a review of literature regarding current theoretical and methodological aspects in the field of distance education. The chapter reviews: the definition of distance education; the concept of teleconferencing; the problem of measuring the effectiveness of distance education programs; some examples of current research in the field of distance education; and methodological aspects of research in distance education.

Defining Distance Education

Distance education has a short history as an academic field. In fact, it was not until 1982 that the term *distance education* formally entered the literature, when the International Council For Correspondence Education changed its name to the International Council for Distance Education (Garrison 1989). This accounts for the origin of the debate in which authors from many countries have been engaged, trying to produce a satisfactory definition of "distance education."

Two attempts to define distance education will be reviewed here. First, the "working" definition by Moore --who has become an academic authority in the field-- proposing that "Distance education consists of all arrangements for providing instruction through print or electronic communication media to persons engaged in planned learning in a place or time different from that of the instructor or instructors" (1991, xv).

Another approach to defining the concept is provided by Garrison and Shale (qtd. in Garrison 1989:6). Instead of giving a definition, these authors identify three criteria to be used to evaluate whether an educational process may be considered distance education: (1) The majority of communications must occur non-contiguously; (2) there must be a two-way communication between teacher and students; and (3) technology must be used to mediate such two-way communication.

Common to both definitions are the ideas of non-contiguousness --in time and/or space-- and the use of some kind of technology to mediate communication --print or electronic. While Moore emphasizes the planned characteristic of distance education, Garrison and Shale give importance to the two-way nature of the communication between teacher and students. For the purposes of this thesis, these two approaches --taken together-- are sufficient to define the field of distance education.

Teleconferencing As A Form Of Distance Education

Olgren and Parker (qtd. in Garrison 1989:65) define teleconferencing as a "Two-way electronic communication between two or more groups, or three or more individuals, who are in separate locations: includes group communication via audio, audiographics, video and computer systems." This definition emphasizes the separation among the parts, the use of technological devices, and the two-way nature of the communication. However, it does not limit teleconferencing to educational purposes.

Johnson (qtd. in Garrison 1989:66) traces the first educational applications of video teleconferencing to the 1960s, when closed circuit television systems became

common. According to Garrison (1989), the availability of new communication technologies, especially satellite delivery, has promoted the advancement of video teleconferencing. In fact, this author maintains that teleconferencing is responsible for a major change in distance education: While correspondence studies were typically a form of individualized instruction, the use of teleconferencing in education has permitted the creation of "a group method of learning at a distance" (p. 66).

Evaluating Distance Education Programs

There has been some discussion about what model should be used to evaluate distance education programs. However, instead of devoting energy to the development of such a model that may be "superfluous," Mark (1991) proposes to follow simple guidelines when evaluating distance education. These guidelines include the determination of "from whose perspective is effectiveness being judged" (students, teachers, support materials developers, and administrators); the level of analysis (individual, sub-unit, organization and societal levels); the purpose of the evaluation; the time frame (longitudinal or cross-section); the use of demographic variables "to gain some profile of institutional or program effectiveness"; and the standards by which data are being evaluated (p.18-20).

Chute, Balthazar and Poston (1991) of the American Telephone and Telegraph (AT&T)'s National Teletraining Center, have conducted diversified, multi-method evaluative research of AT&T's teletraining program. Their research efforts include five areas:

> (1) Instructional effectiveness (e.g. learning, acceptance, appeal, expectations and attributions); (2) cost-benefit analyses (e.g. cost-avoidance, cost-comparisons, and cost-efficiency) . . . (3) course and curriculum development (e.g. national surveys, identification of course and curriculum components, workshops, evaluation of support services); (4)

> media attributes and system implementation; and (5) directions for future research and development. (p. 262).

The AT&T research program is interesting, since it answers different types of questions and seems to follow criteria similar to the guidelines proposed by Mark. Another author (Threlkeld 1991) has analyzed research reports and evaluation studies of distance education programs. The author notes that current research is focusing on answering questions like:

> "How do students perform in distance learning classes?" "What do students, teachers, and administrators think of distance learning classes?" "What are the most significant problems related to distance learning?" "Is distance learning only for the brighter student?" "How important are live and interactive broadcasts?" "How do students compare distance learning classes to traditional classes?" "How does the organizational culture of receiving high-schools impact on distance learning?" (p. F-7).

From a review of the literature, it appears that there is a trend to use several indicators of effectiveness. Although some philosophical discussion has been sustained, the need for empirical evidence to prove the effectiveness (or the lack thereof) of distance education has led researchers to conduct studies in the field, using several indicators to evaluate the programs. Apparently no one of the indicators by itself may provide a comprehensive evaluation of the programs. Instead, it is a combination of several of them, in an organized, logical way, which can produce a reliable measurement of effectiveness.

Examples of Current Research On Distance Education

Coldeway (1991) argues that the distinction between evaluation and research on distance education

> . . . should be kept clear and the differences made more obvious . . . Evaluation is typically concerned with the need to make a decision for

> policy, management or political strategy reasons. In contrast, research is guided by the formulation of hypotheses and is typically focused on external generalization of results. (p. 390-391).

However, given the youth of distance education as an academic field, at this moment it is still difficult to make a clear distinction between both approaches. General ideas about evaluation of distance education programs were presented in the previous section of this review. In this section, several research projects --some of them evaluative-- are described The review is organized according to components of a distance education program. Some of the reported studies are quantitative and others qualitative, in terms of their methodological approach. Similarly, some studies seem to be more rigorous than others. The purpose here is to describe what has been studied on distance education rather than criticize the methodology used.

The Institution - Teaching Component

Distance education programs may vary in the purposes they are intended to serve. While some programs try to homogenize the society by opening educational opportunities to learners who otherwise would not have access to education (Boughton, 1991; Holland, 1989), other programs may pursue economic goals by selling specialized knowledge to industry executive personnel (Emmet and Johnsrud 1991).

At a micro level of analysis, some relevant questions have been proposed: Who does teach in a distance education program? What characteristics must a distance education teacher have to be successful? How are distance educators trained? What kind of relationship exists among teachers, media producers and instructional designers?

An example of this kind of analysis is found in Kearsley (1990). The author studied teacher training programs for distance education and concluded that "there are four major aspects of teacher training for distance education: (i) mastery of the delivery

system involved, (ii) techniques for facilitating student participation, (iii) humanizing skills, and (iv) the ability to work with a team" (p. 3).

Another study analyzed the relationship of role conflict, role ambiguity and job satisfaction among faculty members in a distance education program (Abdul 1988). The study is interesting, since teaching in a distance education system differs from teaching in a conventional setting and may cause role conflict and ambiguity that, according to the study, are positively related to faculty job satisfaction. Other studies, like Wilkinson (1990), have analyzed distance educators' attitudes and their relationship to effectiveness and satisfaction. Willis (1991) proposes guidelines to improve instructors' teaching at a distance.

The Educational Contents Component

Research has been conducted in the area of the educational message presented by distance education. Some areas of analysis have been, for example, types of content used by the teacher --affective and cognitive-- and the types of language employed --verbal and non-verbal communication (Simon and Boyer 1974). Also important at this level has been the relation between teaching techniques and variables like power and motivation (Richmond 1990), and teacher immediacy behavior (Christophel 1990; Hackman and Walker 1990).

Johnston (1991), Kearsley (1990) and the University of Alaska Statewide Distance Education (1986) present detailed analyses of the design, production and use of support materials in distance education. In this case, considerations of creativity, relevancy, clarity, legibility and appropriateness of the usage of support material are pertinent.

The Communication Component

The communication channel --the technological component used to mediate communication between teacher and students-- has been studied in terms of its knowledge transmission capacity, its appropriateness for the kind of educational purposes pursued, its effectiveness and efficiency, and its requirements of design and operations to reduce technical noise.

Kearsly (1990) analyzes print media, audio, television and computers according to their educational potential and requirements. The analysis is replete with hints directed to would-be-teachers and instructional designers of distance education systems.

Lane-Johnson (1989) developed a media selection model and pre-adoption evaluation instrument to be used by personnel in charge of selection of distance education media. It uses knowledge from mediated communication theory to help distance educators in the selection of the most convenient media mixture for their particular needs, purposes and budgets. Emphasis is given to the communication potential of the media instead of their educational pros and cons.

Gilmore (1991) presents a model for building technological infrastructure for distance education. His methodology is based on the level of technical quality the program wishes to achieve, and proposes options for building the whole telecommunications system. The model follows the systems approach and offers detailed explanations for each option, including analyses of effectiveness, efficiency and acceptability. While Kearsley represents the education expert approach to media and Lane-Johnson's paper offers the mass communication expert solution, Gilmore's model represents the engineering approach to the problem.

The Students Component

From a macro perspective, distance learners have been studied as a market and as a media audience. Paul (1990) found that an important segment of the educational market is being served by distance education programs that deliver education directly to corporate sites. According to her findings, many corporate students would not be able to participate in traditional educational programs. In Mexico, an important market for corporate training using distance education systems has also been identified (López and López 1991).

Johnstone (1991) suggests that distance education programs must conduct audience analyses in order to determine "students' entry level behaviors, prerequisite skills, technological proficiencies and motivation to success" (p. 2).

From a micro perspective, receivers have been studied in terms of their characteristics, with the purpose of creating a typology of distance learners, or to identify their learning patterns. Farrel (1989) conducted a multivariate statistical analysis of a sample of distance learners in order to create a typology of distance learners based on seven statistically constructed clusters. The categories include inactive learners; recreational learners; academically oriented learners; employed and career oriented learners; young, recreative learners; well educated, well paid, career and personal/family oriented learners; and married, personal/family developed, practically oriented learners (p. 1).

Bossons (1988) found significant relationships between combinations of student personal traits and studying styles, and the degree of success in distance learning. Student motivation can also be analyzed as a characteristic of distance learners in relation to success. For example, Wilkes (1989) found significant but weak relationships between initial student motivation level and satisfaction with the distance learning experience.

Many distance education programs include two elements related to the reception component that can be studied: the receiving site coordinator and the presence of a learning group instead of individual reception. Payne (1989) suggests that the most important characteristics of site coordinators are cognitive, affective and managerial skills, in that order. Kartasurya (1990) found that distance learners who received the courses as a group experience had better results than those who received the courses by themselves.

Another important variable that has been analyzed in relation to distance learners is that of cultural differences. In places like Alaska, for example, cultural diversity of students demands a special consideration in order to avoid misunderstandings, or a complete lack of understanding. For example, use of humor --that works favorably in other contexts-- is usually avoided since it is mostly culture-related (Sponder, 1990).

The Interaction Component

Interaction between teacher and students has been analyzed in terms of its synchronicity or asynchronicity. Jaspers (1991) suggests that the relevant question is not whether an educational program is interactive, but how fast and to what extent interaction occurs. Some communication media allow immediate --synchronical-- interaction while others allow delayed --asynchronical-- interaction. Further research can answer questions like what type of interaction works better and under what circumstances; and what is the maximum delay that interaction may allow without becoming dysfunctional.

Research Methodology In Distance Education

A conclusion can be drawn from the review of literature on distance education: the field of study is complex, involving several elements, and its study demands comprehensive, multi-level approaches. In this section, two methodological aspects will be discussed: the concept of multi-level analysis and the concept of follow-up study.

Multi-level Analysis

The fields of distance education and mass communication share some methodological and theoretical problems. That is why each of the fields can borrow from the other those approaches that may help to solve common problems.

According to Pan and McLeod (1991), a multi-level analysis is required to give sense to the enormous amount of knowledge about mass communication, varying from physiological studies to determine individual reaction to stimulation, to national and international analyses of communication systems. They argue that there is nothing wrong with the study of mass communication at the micro or macro levels, as long as a multi-level perspective is used "to link various theoretical 'maps'" (p.141). They propose a multi-level framework based on Coleman's four types of theoretical relationships: "macro to macro, macro to micro, micro to micro and micro to macro" (p. 147).

As shown in the previous section of this review, the field of distance education has also produced a considerable amount of knowledge about each of the components of the process. Thus, a multi-level approach can be used to study distance education in order to avoid what Pan and McLeod call "a major problem . . . (in which) cross-level linkages are omitted, or are assumed to be captured by simple aggregation or reduction" (p. 149).

Although there is no single approach that can study the whole process of distance education at once, certainly a methodological design that allows for the measurement of cross -level relationships may help to build a comprehensive theory of distance education.

Follow-up Studies

Willén (1984) conducted a comprehensive study of distance education in Sweden. The study included the measurement of variables at different levels of analysis --it was in fact a multi-level analysis, though the author does not use that term-- and a follow-up

approach. Besides measuring the variables in the present time, the author studied former students five years after their completion of the program. According to the author, it was "essential to study adult education activities from the standpoint of the individual's circumstances and over a long period of time" (p. 27).

Among several other findings, the study found that a large proportion of the group (79 percent) described distance education as a positive experience; that about 76 percent of the participants finished their studies in fewer than five years; and that for about 20 percent of the respondents, distance education influenced their occupational situation positively.

Besides its findings, this study is important because it points toward a key idea regarding distance education: some benefits of participating in distance education are not immediate, and therefore, they must be measured in the long run, using a follow-up approach.

Summary Of Literature Reviewed

Distance education is a relatively new academic field. Therefore, theoretical and methodological issues are just in the process of being defined. Distance education is an organized effort to provide instruction to people who do not share a spatial and/or temporal situation. Technological devices are used to mediate the two-way communication required by teachers and students to advance their educational purposes.

Video teleconferencing is a form of distance education. Video and audio technologies are used to mediate between the institution providing the education and the students participating in the program. New technologies, such as satellite communications, have promoted the rapid expansion of the field.

The measurement of effectiveness of distance education programs has been subject of discussion. Different criteria have been used to measure effectiveness.

However, it seems that comprehensive measurements of effectiveness can be achieved only if several indicators are combined in a logical, organized model.

Although not a highly developed field, research in distance education has provided information and some theoretical models about different components of the process, such as the teaching institution, the program contents, the communication channel, the students, and the interaction.

From a review of the literature in the field, it appears that two methodological considerations may be important to the design of comprehensive research projects on distance education. First, the use of multi-level studies --that is, studies that measure variables at different levels of analysis-- and second, the measurement of distance education influences through time, by following-up former participants.

CHAPTER III

METHODOLOGY

This chapter describes the methodology used in the study. It includes the research approach, the research design, the selection of subjects, the research instruments, the data collection plan, the data processing and analysis, the methodological assumptions, and the methodological limitations of the study.

Research Approach

This study was based on a mail survey that included subjects from three levels of analysis: former students, teaching partners, and administrators of participanting schools in ASTS mathematics courses. Two groups were included: one group from the *AP Calculus By Satellite* course, and the other from the *Trigonometry/Analytic Geometry By Satellite* course.

Three different questionnaires were used, one for each level of analysis. Particular questions were used to measure variables that can be used to evaluate the effectiveness of the courses at each of the levels. In a similar way, demographic variables were analyzed at each of the levels involved.

An identical set of questions evaluating the experience of ASTS participants was included in the three questionnaires in order to allow for cross-level analysis of results. The questionnaire design is discussed in a later section, and copies of the questionnaires can be found in the Appendices of this thesis.

Research Design

The study was designed to accomplish the three objectives of the project: to provide a comprehensive measurement of the effectiveness of ASTS mathematics courses; to identify factors statistically related to the ASTS evaluation by former participants; and to provide a basic demographic profile of the participants in ASTS mathematics courses.

A set of variables was developed for each of the objectives, and hypotheses were stated to guide the analysis and interpretation of data. In this section, variables and hypotheses are described, according to each of the three objectives.

Measuring The Effectiveness Of ASTS Mathematics Courses

As stated in Chapter I, this study was concerned with providing a comprehensive measurement of the effectiveness of ASTS mathematics courses. To accomplish this, several variables were identified at each of the three levels of analysis. No variable -- alone--may be seen as a definitive evaluation of the program; instead, it is a set of variables which may provide a general idea --though not a complete one-- about how effective the program has been as an alternative to conventional education.

Variables At The Student Level

College attendance. Four possible options were included: (1) Currently attending college; (2) Already graduated from college; (3) College drop-out; and (4) Never attended college.

College GPA. This variable measured the Grade Point Average obtained by the student while attending college, using the conventional scale in which 4.0 is the highest value.

Perceived degree of preparedness to take college-level mathematics courses. This variable included the perception of those students attending college regarding two points: (1) How well prepared the student was to take college-level mathematics courses; and (2) the students' perception of his/her relative position (advantage or disadvantage) with respect to other college students when taking mathematics courses. These two components of the variable were measured using a five-point scale including "Strongly agree," "Agree," "Uncertain," "Disagree," and "Strongly Disagree."

Results obtained in AP exams. This variable applied only to AP Calculus students, and was measured by the percentage of students who obtained 3 or more in the AP Calculus AB exam. The results of the exam were measured from 1 (minimum) to 5 (maximum), where 3 is usually considered satisfactory.

Reasons for participating in ASTS mathematics courses. This variable was defined as the rating by students of a set of eight possible reasons to participate in the courses, on a six-point scale in which the extremes were "Most important" and "Least important." The reasons can be grouped in four types: (1) Reasons related to availability of options ("It was the only way I could take a calculus --or trigonometry/analytic geometry-- course"); (2) Reasons related to college preparation ("I planned to take an AP exam," I wanted to prepare for college," and "I wanted to get an idea about how a college course would be"); (3) Reasons related to external motivation ("My teacher encouraged me to take the course," and "I was forced to take the course"); and (4) Reasons related to individual preferences ("It was a personal challenge," and "I wanted to experience a television course").

Evaluation of the experience. This variable measured the satisfaction of former students with the experience of participating in ASTS mathematics courses. The variable included eight indicators: seven of them referred to specific elements of the course and the eighth was an overall evaluation of the experience. Evaluation of specific items was measured using a scale of five steps, in which the extremes were "Very good" and "Very

poor," and the mid-point was "Fair." Overall evaluation of the experience was measured using a scale with five points: "Very satisfactory," "Satisfactory," "Uncertain," "Unsatisfactory," and "Very Unsatisfactory."

The seven specific elements of the course were: Quality of written materials (course guides); Teaching partner performance; Relevance of the course content; OSU professor performance; Access to OSU professor and staff for advice; Quality of television broadcasts; and Knowledge of the subject (either Calculus or Trigonometry/Analytic Geometry) after taking the course.

Variables At The Teaching Partner Level

Perception of the experience as a professional development opportunity. This variable was defined as the level of agreement or disagreement with the statement: "AP Calculus (or Trigonometry/Analytic Geometry) By Satellite has been a good professional development opportunity for me." A five-point scale was used, with the following steps: "Strongly agree," "Agree," "Uncertain," "Disagree," and "Strongly disagree."

Satisfaction with being teaching partner. This variable was measured with a five-point scale answering the question: "How satisfied are you with being an AP Calculus (or Trigonometry/Analytic Geometry) By Satellite teaching partner?" The steps in the scale were: "Very satisfied," Satisfied," "Uncertain," "Unsatisfied," and "Very unsatisfied."

Evaluation of the experience. This variable was measured in a way similar to that used for the student level evaluation. There was only one difference with respect to the set of items rated by the students: Instead of using the item "Teaching partner performance," at this level the item was replaced by "Teaching partner training."

Variables At The School Administrators Level

Perception of the experience as a help to improve the mathematics curriculum at the school. This variable was defined as the level of agreement or disagreement with the

statement: "AP Calculus (or Trigonometry/Analytic Geometry) By Satellite has helped this school to improve its mathematics curriculum." A five-point scale was used with the following steps: "Strongly agree," "Agree," "Uncertain," "Disagree," and "Strongly disagree."

Number of former teaching partners currently teaching mathematics in the school. This variable identified the number of teachers who participated as teaching partners in ASTS mathematics courses and now are employed by the school as mathematics teachers.

Evaluation of the experience. This variable was measured in exactly the same way as the teaching partner-level evaluation.

Identifying Factors Statistically Related To The Evaluation of ASTS Mathematics Courses

Variables

The variables used for this statistical analysis were the *Evaluation of the experience* --including the seven items and the overall evaluation; the demographic variable *Gender*; and the categorical variables *Course* (AP Calculus or Trigonometry/ Analytic Geometry) and *Level* (student, teaching partner and school administrator).

The analysis consisted of two parts: First, an analysis of correlation between each of the seven specific items and the overall evaluation; and second, an analysis of variance for the overall evaluation, in which the latter was the dependent variable, and *Gender*, *Course* and *Level* the categorical variables. The variable *Gender* was used only at the student level.

Hypotheses

Two hypotheses were tested in this section. Stated as null hypotheses for statistical purposes, the hypotheses were:

Null Hypothesis 1. There is no relationship between each of the seven specific items of the variable *Evaluation of the experience*, and the overall evaluation.

Null Hypothesis 2. There are no differences in results for the overall *Evaluation of the Experience*, by *Gender*, *Course* and *Level*. (*Gender* was tested only at the student level).

Demographic Profile of Participants In ASTS Mathematics Courses

The following demographic variables were measured in order to create a basic demographic profile of the participants in ASTS mathematics courses.

Variables At The Student Level

Age. Chronological age at the time of answering the survey.

Gender.

High School GPA. High School Grade Point Average as reported by the student.

High School class ranking. Relative position reported by the student with respect to his/her high school class. Five options were included: "Top 20 percent," "Second 20 percent," "Middle 20 percent," "Fourth 20 percent," and "Lowest 20 percent."

Type of job. Type of job ("Part time," "Full time," and "Own business) of those students who reported having a job.

College attended by former students. College or university attended by those students who reported having been college students.

College major. Major reported by those students attending college.

Variables At The Teaching Partner Level

Age. Chronological age at the time of answering the survey.

Gender.

Years of experience as teacher. Number of years employed as teacher as reported by the teaching partners.

Certification as mathematics teacher. Whether the teaching partner is currently a certified mathematics teacher.

Certification as mathematics teacher during the first year he/she was a teaching partner. Whether the teaching partner was a certified mathematics teacher during the first year he/she was a teaching partner.

Variables At The School Level

Size of the student body. Number of students attending the school at the time of answering the survey, as reported by the school administrator.

Number of grades offered in the high school. Levels --grades-- offered by the school.

Number of students taking mathematics courses. Number of students taking mathematics courses at the time of answering the survey, as reported by the administrator.

Number of certified mathematics teachers teaching at the high school. Number of certified mathematics teachers employed by the school at the time of answering the survey, as reported by the administrator.

Ratio of number of mathematics students to certified mathematics teachers. This variable was computed by dividing the number of students taking mathematics courses by the number of certified mathematics teachers employed by the school.

Research Instruments

Six different questionnaires were constructed as data collection instruments. Actually, they were two slightly different versions --one for each course-- of three different questionnaires --one for each level of analysis. Copies of the questionnaires are included in the Appendices of this thesis.

Given the large number of variables --and the use of sets of indicators for some of the variables-- the questionnaires were constructed using structured questions as much as possible. Few questions were of the open-ended type, and they were included to allow respondents to elaborate on answers to structured questions, or to provide suggestions to improve the courses. Additionally, graphic design considerations were taken into account to produce an attractive, easy-to-answer questionnaire. As a result, each questionnaire required less than ten minutes to be answered.

The use of structured questions --dichotomous, multiple choice and scales-- allowed the pre-coding of the answers which facilitated the capture of data into computer files. Open-ended questions had to be coded while entering data in the computer.

Two types of interval scales were used: five-point and six-point scales. While five-point scales were preferred for most of the questions related to attitudes, six-point scales were used in questions that measured the importance of certain reasons in making a decision, such as participating in ASTS courses.

The questionnaires were reviewed by a group of ten people, including OSU students working as assistants to AP Calculus and Trigonometry/Analytic Geometry courses and ASTS personnel who keep in contact with school administrators and teaching partners. The OSU professors in charge of the courses also reviewed the questionnaires. The comments, concerns, and suggestions provided by the reviewers were used to improve the final version of the instruments.

Each questionnaire was accompanied by a cover letter, describing the nature of the research, guaranteeing the confidentiality of data, providing instructions and deadlines to respond, and supplying names and telephone numbers of persons at OSU who could provide further information about the study. Copies of the cover letters are included with the questionnaires in the Appendices of the thesis.

As a courtesy to the respondents, an addressed, postage-paid envelope was included with each questionnaire.

Selection Of Subjects

The population of the study included six natural groups: former students, former teaching partners, and school administrators of former participating schools, for each of the two courses (AP Calculus and Trigonometry/Analytic Geometry).

ASTS central office does not systematically keep records of former participants. However, the OSU professors had yearly files that included names and addresses of former students and teaching partners, collected with the purpose of creating a class roster. Since the teaching partners were responsible for collecting the data and sending it to OSU, it can be assumed that the information is almost complete. Still, it cannot be assumed to be a definitive list of all former participants' names and addresses, and this is a limitation of the study.

Another problem with this information was that for AP Calculus there were no students' address records prior to 1991. Thus, the study had to be limited to former students who took the course during the 1991-1992 school year. However, the records for Trigonometry/Analytic Geometry included information since 1987, the year when the course started.

TABLE 2

POPULATION SIZE BY GROUPS

COURSE	STUDENTS	TEACH. PART.	SCHOOLS	TOTAL
AP Calculus	287	129	120	536
Trig./A. Geom.	234	63	60	357
TOTAL	521	192	180	893

Table 2 (page 31) shows the population size for each group. Although the total number of subjects was large enough to justify the selection of a sample, it was decided to include the whole population in the study because of the relatively small number of subjects in each group.

Data Collection Plan

The questionnaire to the student group was sent during the second week of December, 1991, with January 15, 1992 as the deadline to respond. Since the available addresses corresponded to the students' family homes, it was decided to send the survey just before Christmas time, when it was assumed college students would be likely to be visiting their parents. A follow-up questionnaire, including a cover letter and an addressed, postage-paid envelope, was sent during the third week of January, 1992, with February 15, 1992 as the deadline to respond.

The questionnaires to the teaching partner and school administrator groups were sent only once, during the third week of January, 1992, with February 15 as the deadline. Student and teaching partner questionnaires were sent in envelopes addressed with their names. School administrator envelopes were addressed with the generic tittle "Principal" followed by the name of the school.

Data Processing And Analysis

Data were processed and statistically analyzed using a Macintosh computer running SYSTAT v.5.1. The statistical tools employed for the analysis of data are described in this section.

Descriptive Statistics

In order to accomplish the first objective --to collect information that can be used to build a comprehensive measurement of effectiveness of ASTS mathematics courses--

descriptive statistics were used. These statistics were: Mean, variance, standard deviation, and standard error of the mean for score-type variables, and cross-tabulation --frequencies and percentages-- for nominal-type variables.

The measurement of effectiveness was an interpretation of these descriptive statistics, according to a set of parameters previously determined. Results are presented and discussed in Chapter IV.

Demographic variables were also analyzed using the same set of descriptive statistics used to measure effectiveness. A profile of ASTS participants was constructed as an interpretation of such statistics.

Analysis Of Correlation

A Pearson correlation r coefficient was computed to test the relationship between each of the seven specific items included in the variable *Evaluation of the experience* and the overall evaluation. This coefficient was computed both for each group of respondents, and for all respondents taken as one group. Results and their discussion are presented in Chapter IV.

Analysis Of Variance

A two-factor analysis of variance was computed for the three levels, using the overall *Evaluation of the experience* as the dependent variable, and *Level* and *Course* as categorical variables. Another two-factor analysis of variance was computed for the student group only, using the overall *Evaluation of the experience* as the dependent variable, and *Gender* and *Course* as categorical variables.

Methodological Assumptions

The study was based on the following methodological assumptions:

First, it was assumed that the questionnaires were answered by the intended respondents, either former students, teaching partners, or school administrations. Similarly, a candid, frank completion of the questionnaire was assumed.

It was also assumed that the review of initial drafts of the questionnaire eliminated from the final version those questions and directions that could be difficult to understand by the respondents.

Limitations Of The Study

The study had several limitations due to methodology. The following are the most important of them.

First, although the study attempted to measure effectiveness of ASTS mathematics courses in a comprehensive way, the measurement was far from a complete one. Despite the use of several indicators of effectiveness --in opposition to the use of only one criterion-- there are many other criteria that could be used to measure effectiveness. Thus, the measurement of effectiveness proposed by this study is limited to the definition of the concept *effectiveness* as discussed in Chapter I; to the the set of indicators described in this chapter; and to the parameters used to interpret whether the courses were effective, as discussed in Chapter IV.

Another important limitation of the study is the less than perfect response rate. In a study such as this one in which the whole population was surveyed, even if the response rate --percentage of questionnaires returned-- were high, there would not be a guarantee that the respondents were a representative sample of the population. It might be that those who did not answer the survey were systematically different in some way from those who decided to participate. Therefore, the results of the study are limited to the percentage of the population that answered the mail survey.

The population frame --the listing of all the members of the population-- was not complete (e.g., it did not include AP Calculus students who took the course prior to 1991)

and might be inaccurate, given that it was not originally collected and kept in an organized way for research, statistical or administrative long-term purposes. Thus, the study might have left out of the survey former participants whose names and addresses were absent from the population listing.

The analysis of data was conducted without differentiating the responses provided by former participants in different years. This is a limitation since for some respondents, the experience of participating in ASTS mathematics courses was closer --or farther-- in time than for others, and therefore their answers could be affected by the time factor.

Summary

This study used a mail survey questionnaire research approach. Three main types of variables were measured, for both AP Calculus and Trigonometry/Analytic Geometry courses, at each of three levels (former students, teaching partners and school administrators).

The types of variables were: A set of variables used as indicators of the effectiveness of ASTS mathematics courses; a set of scales asking the respondents to rate specific items of the course as well as an overall evaluation, in order to identify what items were statistically related to the overall evaluation; and a set of demographic variables used to build a demographic profile of the participants in ASTS mathematics courses.

Six different questionnaires were sent, one for each of the six groups. The questionnaires were reviewed by a group of college students involved in ASTS mathematics courses as assistants, by the OSU professors teaching both courses, and by ASTS personnel. Corrections and improvements were included in the final versions of the instruments.

The mail survey was sent to the whole population. Names and addresses of the subjects were obtained from records kept by the OSU professors who taught the ASTS

mathematics courses. Since AP Calculus did not have students' address records prior to the school year 1991-1992, only those students who took AP Calculus in 1991 were included in the survey. The rest of the groups included former participants since 1987.

Data were collected, coded and entered in a computer where three types of statistical analysis were conducted: Descriptive statistics, analysis of correlation, and analysis of variance. The statistics were used to evaluate the effectiveness of the courses, to test statistical hypotheses regarding relationships between/among the variables, and to build a demographic profile of former ASTS participants.

Four methodological issues limit the results of this study: Although effectiveness was measured using several criteria, the measurement was far from a complete one; the response rate was less than perfect, and since the respondents chose whether to participate in the study, they could not be assumed to be a representative sample of the population; the lists of members of the population were incomplete; and the study did not differentiate the responses provided by former participants in different years.

CHAPTER IV

ANALYSIS OF DATA

This chapter presents and discusses the findings of the study. Statistics are presented in the form of tables, with a brief narrative. Findings are discussed in separate sections, following the description of statistics.

Response Rate

An important issue in any survey study is the response rate, or percentage of response. This study identified and mailed questionnaires to the entire population of subjects in each category rather than to a sample of subjects from each population. The overall response rate was 37.84 percent, as showed in *Table 3*. The rate varies from group to group: AP Calculus (APC) students had a response rate of 48.08 percent, while Trigonometry/Analytic Geometry (TGA) school administrators had a rate of 20.00 percent. Overall, APC participants had a larger response rate than TAG participants.

To test how representative this self-selected sample might be, three analyses were conducted. First, the sample and the population were compared in terms of the variable *Gender*. *Table 4* shows the results of the comparison. Since gender of the school administrators was not asked in the questionnaire, the comparison included only students and teaching partners.

TABLE 3

RESPONSE RATE BY GROUPS

GROUP	Q. Sent	Q. Received	Resp. Rate
APC Students	287	138	48.08
APC Teaching Partners	128	51	39.84
APC School Administr.	120	31	25.83
TAG Students	234	91	38.88
TAG Teaching Partners	63	15	23.80
TAG School Administr.	60	12	20.00
APC TOTAL	535	220	41.12
TAG TOTAL	357	118	33.05
OVERALL	892	338	37.89

Response rate: Percentage of response.

A test for significance of the proportion of females in the sample with respect to the proportion of females in the population was conducted for the four groups. None of the *z* coefficients obtained from the analysis was significant at the 95 percent level of confidence. The coefficients obtained were: APC students: 0.4013; APC teaching partners: -0.025; TAG students: 1.4302; and TAG teaching partners: 0.7136. The critical *z* coefficient at the 95 percent level of confidence was ±1.96.

A dependent (paired) t-Test was conducted to identify whether the sample of former students represented the population in terms of the high schools they attended. The t-Test compared the percentages with which each school contributed to the population and to the sample. Actually, the test compared the percentages after being transformed, using the arcsin percentage transformation, as suggested by Steel and Torrie (1980) in order to make the means and variances independent and the variance stable.

Table 5 (referring to APC) and *Table 6* (referring to TAG) show the high schools included in the study, the number of questionnaires sent to former students of those schools, the number of questionnaires returned by former students from each school, the respective percentages, and the transformed percentages. None of the t values was significant at the 95 percent level of confidence.

TABLE 4

GENDER COMPARISON BETWEEN SAMPLE AND POPULATION

	FREQUENCIES			PERCENTAGES		
	Female	Male	TOTAL	Female	Male	TOTAL
APC Students						
Population	152	128	287	52.96	47.03	100.00
Sample	71	66	137	51.82	48.18	100.00
APC Teaching Partners.						
Population	68	60	128	53.12	46.87	100.00
Sample	27	24	51	52.94	47.05	100.00
TAG Students						
Population	135	99	234	57.69	42.30	100.00
Sample	58	31	89	65.17	34.83	100.00
TAG Teaching Partners.						
Population	33	30	63	52.38	47.61	100.00
Sample	6	8	14	42.86	57.14	100.00

TABLE 5

FORMER AP CALCULUS STUDENTS RESPONSE BY HIGH SCHOOL

School Name	Q. Sent	Q. Rec.	% Sent	% Rec.	Tran. Sen	Tran. Rec
Alluwe High School.	1	1	0.34	0.73	3.34	4.90
Annville Cleona High S.	3	2	1.04	1.46	5.74	6.80
Ardmore High School.	13	4	4.52	2.92	12.11	9.81
Arkoma High School.	2	1	0.69	0.73	4.76	4.90
Avon High School	3	0	1.04	0.00	5.74	0.00
Bellevue High School	3	0	1.04	0.00	5.74	0.00
Berryhill High School	2	0	0.69	0.00	4.76	0.00
Cadillac High School.	6	2	2.09	1.46	8.13	6.80
Cambria Heights High S.	20	11	6.96	8.03	15.23	16.43
Caruthersville High School.	6	3	2.09	2.19	8.13	8.33
Centralia High School	1	0	0.34	0.00	3.34	0.00
Cherokee County High S.	1	0	0.34	0.00	3.34	0.00
Cheyenne High School	1	0	0.34	0.00	3.34	0.00
Clarksdale High School	5	0	1.74	0.00	7.49	0.00
Colcord High School.	5	1	1.74	0.73	7.49	4.90
Coleman High School.	9	4	3.13	2.92	10.14	9.81
Columbia Burbank High S.	1	1	0.34	0.73	3.34	4.90
Crest Ridge High School.	1	1	0.34	0.73	3.34	4.90
Deer Creek-Lamont High S.	5	5	1.74	3.65	7.49	10.94
Douglass High School.	4	2	1.39	1.46	6.55	6.80
Ellsworth High School.	9	6	3.13	4.38	10.14	11.97
Fredericktown High School.	9	9	3.13	6.57	10.14	14.77
Freedom High School.	1	1	0.34	0.73	3.34	4.90
Guntersville High School.	14	4	4.87	2.92	12.66	9.81
Hueytown High School.	7	5	2.43	3.65	8.91	10.94
Huffman High School.	20	2	6.96	1.46	15.23	6.80
Jemison High School.	16	11	5.57	8.03	13.56	16.43
Kennett High School.	3	3	1.04	2.19	5.74	8.33
Lahoma Public School	1	0	0.34	0.00	3.40	0.00
Liberty High School.	7	4	2.43	2.92	8.91	9.81

TABLE 5 (Continued)

School Name	Q. Sent	Q. Rec.	% Sent	% Rec.	Tran. Sen	Tran. Rec
Logan High School.	4	3	1.39	2.19	6.55	8.33
Lyons High School.	5	3	1.74	2.19	7.49	8.33
Madisonville High School.	7	2	2.43	1.46	8.91	6.80
Man Senior High School.	6	6	2.09	4.38	8.13	11.97
Mcadory High School.	9	3	3.13	2.19	10.14	8.33
Meshik School	1	0	0.34	0.00	3.40	0.00
Moberly Senior High S.	5	1	1.74	0.73	7.49	4.90
North Nodaway High S.	2	1	0.69	0.73	4.76	4.90
Notasulga High School.	4	1	1.39	0.73	6.55	4.90
Nowata High School.	1	1	0.34	0.73	3.34	4.90
Phillips High School.	3	2	1.04	1.46	5.74	6.80
Pinson Valley High School.	9	4	3.13	2.92	10.14	9.81
Ramsay High School.	16	8	5.57	5.84	13.56	13.94
Rosamond High School.	1	1	0.34	0.73	3.40	4.90
Russell County High School	6	1	2.09	0.73	8.13	4.90
Seminole High School.	2	1	0.69	0.73	4.76	4.90
South Park High School.	9	5	3.13	3.65	10.14	10.94
Sweetwater High School.	10	5	3.48	3.65	10.63	10.94
West County R-IV.	7	6	2.43	4.38	8.91	11.97
Woodland High School	2	0	0.69	0.00	4.76	0.00
Worth County R-3	1	0	0.34	0.00	3.40	0.00

Paired samples t-Test: t = -1.827 DF = 51 P = 0.073.

TABLE 6

FORMER TRIGONOMETRY/ANALYTIC GEOM.
STUDENTS RESPONSE BY HIGH SCHOOL

School Name	Q. Sent	Q. Rec.	% Sent	% Rec.	Tran. Sen	Tran. Rec
Alluwe High School	1	0	0.43	0	3.76	0.00
Attica High School.	6	6	2.59	6.67	9.10	14.89

TABLE 6 (Continued)

School Name	Q. Sent	Q. Rec.	% Sent	% Rec.	Tran. Sen	Tran. Rec
Bismarck R-V.	7	4	3.02	4.44	9.98	12.11
Central Sallisaw.	20	10	8.62	11.11	17.05	19.46
Chapmanville High School.	18	11	7.76	12.22	16.11	20.44
Craftsbury Academy.	5	1	2.16	1.11	8.33	6.02
Dewar High School	2	0	0.86	0	5.32	0.00
Durant Public School.	4	3	1.72	3.33	7.49	10.47
Eagletown High School.	5	2	2.16	2.22	8.33	8.53
Elmore City High School.	4	2	1.72	2.22	7.49	8.53
Gilman High School	2	0	0.86	0	5.32	0.00
Hartshorne High School.	4	3	1.72	3.33	7.49	10.47
Haviland High School	3	0	1.29	0	6.29	0.00
Heavener High School.	14	3	6.03	3.33	14.18	10.47
Kremlin-Hillsdale	5	0	2.16	0	8.33	0.00
Laddonia Community R-6	7	0	3.02	0	9.98	0.00
Logan High School.	9	2	3.88	2.22	11.24	8.53
Marquand-Zion High S.	2	1	0.86	1.11	5.32	6.02
Norma C. O'bannon	12	5	5.17	5.56	13.05	13.56
North Callaway High S.	9	2	3.88	2.22	11.24	8.53
Noxubee County High S.	15	4	6.47	4.44	14.65	12.11
Port Gibson High School.	19	7	8.19	7.78	16.54	16.11
Prattsburg Central.	14	6	6.03	6.67	14.18	14.89
Ripley High School.	4	2	1.72	2.22	7.49	8.53
Shiloh High School	1	0	0.43	0	3.76	0.00
Talihina High School.	6	4	2.59	4.44	9.10	12.11
Texhoma High School.	10	2	4.31	2.22	11.97	8.53
Union High School.	5	3	2.16	3.33	8.33	10.47
Wetumka High School.	3	2	1.29	2.22	6.29	8.53
Wilson High School.	4	1	1.72	1.11	7.49	6.02
Woodland High School.	12	4	5.17	4.44	13.05	12.11

Paired samples t-Test: t = -1.478 DF = 30 P = 0.150.

Another dependent (paired) t-Test was conducted to identify whether the sample of former students represented the population in terms of the states where they lived during the time they attended high school. The percentages for each state were also transformed using the arcsin percentage transformation, prior to being tested. *Table 7* (referring to APC) and *Table 8* (referring to TAG) show the states included in the study, the number of questionnaires sent to former students of those states, the number of questionnaires responded by former students from each state, the respective percentages, and the transformed percentages. None of the t values was significant at the 99 percent level of confidence.

TABLE 7

FORMER AP CALCULUS STUDENTS RESPONSE BY STATE

State	Q. Sent	Q. Rec.	% Sent	% Rec.	Tran. Sen	Tran. Rec.
Alabama	105	30	36.59	21.90	37.17	27.83
Alaska	1	0	0.35	0.00	3.34	0.00
California	1	1	0.35	0.73	3.34	4.90
Colorado	5	3	1.74	2.19	7.49	8.33
Illinois	2	0	0.70	0.00	4.76	0.00
Kansas	10	6	3.48	4.38	10.63	11.97
Maine	2	0	0.70	0.00	4.76	0.00
Michigan	6	2	2.09	1.46	8.13	6.80
Mississippi	6	0	2.09	0.00	8.13	0.00
Missouri	23	26	8.01	18.98	16.43	25.77
Ohio	9	9	3.14	6.57	10.14	14.77
Oklahoma	47	22	16.38	16.06	23.81	23.58
Pennsylvania	32	17	11.15	12.41	19.46	20.62
Tennessee	17	7	5.92	5.11	14.06	13.05

TABLE 7 (Continued)

State	Q. Sent	Q. Rec.	% Sent	% Rec.	Tran. Sen	Tran. Rec.
Texas	3	0	1.05	0.00	5.74	0.00
Washington	1	1	0.35	0.73	3.34	4.90
West Virginia	17	13	5.92	9.49	14.06	17.85

Paired samples t-Test: t = -0.732 DF = 16 P = 0.475.

TABLE 8

FORMER TRIGONOMETRY/ANALYTIC GEOMETRY
STUDENTS RESPONSE BY STATE

State	Q. Sent	Q. Rec.	% Sent	% Rec.	Trans. Sen.	Trans. Rec.
Illinois	1	0	0.43	0.00	3.72	0.00
Kansas	9	6	3.85	6.67	11.24	14.89
Maine	12	4	5.13	4.44	13.05	12.11
Mississippi	50	21	21.37	23.33	24.49	28.86
Missouri	29	7	12.39	7.78	20.53	16.11
New York	14	6	5.98	6.67	14.06	14.89
Oklahoma	78	29	33.33	32.22	35.24	34.57
Vermont	5	1	2.14	1.11	8.33	6.02
West Virginia	34	16	14.53	17.78	22.38	24.88
Wisconsin	2	0	0.85	0.00	5.29	0.00

Paired samples t-Test: t = 0.559 DF = 9 P = 0.590.

Measuring The Effectiveness Of ASTS Mathematics Courses

The following sections present descriptive statistics for the variables used to measure the effectiveness of ASTS mathematics courses, describe a model to measure the effectiveness of the courses, and apply it to the actual findings.

Descriptive Statistics At The Student Level

College Attendance

Table 9 presents data regarding college attendance by former ASTS mathematics students. The majority of them are attending college (91.97 percent for APC, and 86.81 percent for TAG); only one former student has already graduated from college; three have dropped-out from college; and some never attended college (7.30 percent for APC, and 9.89 percent for TAG).

TABLE 9

FORMER ASTS MATHEMATICS STUDENTS ATTENDING COLLEGE

CATEGORIES	1	2	3	4	TOTAL
AP Calculus					
Frequencies	126	0	1	10	137
Percentage	91.97	0.00	0.73	7.30	100.00
Trig./A.Geom.					
Frequencies	79	1	2	9	91
Percentage	86.81	1.10	2.20	9.89	100.00

Categories: 1: "Attending college;" 2: "Already graduated from college;" 3: "College drop-out;" 4: "Never attended college."

College Grade Point Average (GPA)

Table 10 shows data regarding college GPA of former ASTS mathematics students. The mean for both groups is over 3.0 (3.344 for APC, and 3.111 for TAG). Variance for both cases is low (0.379 and 0.329, respectively).

TABLE 10

FORMER ASTS MATHEMATICS STUDENTS' COLLEGE GPA

	AP Calculus	Trig./A. Geom.
Number of cases	114	76
Mean	3.344	3.111
Variance	0.379	0.329
Standard deviation	0.616	0.574
Standard Error	0.058	0.066

Perceived Degree of Preparedness To Take College-Level Mathematics Courses

Table 11 presents data regarding the two indicators used to measure this variable. The indicators were: Level of preparation to take college-level mathematics courses, and relative position (advantage or disadvantage) with respect to other college students. The table has two parts, one for each of the indicators. Data included in the table are: Distribution of frequencies and percentages, according to the five possible values of the scale; and mean and standard deviation, considering the scale as a score measurement.

TABLE 11

PERCEIVED DEGREE OF PREPAREDNESS TO TAKE COLLEGE-LEVEL MATHEMATICS COURSES

"When I went to college, I was adequately prepared to take college-level mathematics courses."

	1	2	3	4	5	TOT.	Mean	St. De.
AP Calculus							1.520	0.670
Frequencies	69	46	6	2	0	123		
Percentages	56.10	37.40	4.88	1.63	0.00	100.00		
Trig./A. Geom.							2.050	0.926
Frequencies	22	40	12	4	2	80		
Percentages	27.50	50.00	15.00	5.00	2.50	100.00		

Categories: 1: "Strongly agree;" 2: "Agree;" 3: "Uncertain," "4: Disagree," and 5: "Strongly disagree."

"When I took to college-level courses, I was at a disadvantage with respect to other students."

	1	2	3	4	5	TOT.	Mean	St. De.
AP Calculus							1.795	0.670
Frequencies	58	41	16	4	3	122		
Percentages	47.54	33.61	13.11	3.28	2.46	100.00		
Trig./A. Geom.							2.139	0.997
Frequencies	20	39	12	5	3	79		
Percentages	25.32	49.37	15.19	6.33	3.80	100.00		

Categories: 1: "Strongly disagree;" 2: "Disagree;" 3: "Uncertain," "4: Agree," and 5: "Strongly agree."

For both indicators, APC students had a lower mean (1.520 and 1.795) than TAG students (2.050 and 2.139). The majority selected either category "1" or "2" (for APC, the

combined percentage was 93.50 percent for the first indicator, and 81.15 for the second; while for TAG the combined percentage was 77.50 and 74.69, respectively).

Results Obtained In AP Exams

This variable applied only to AP Calculus, since that course was supposed to prepare students to take the Advance Placement (AP) exam in Calculus. A total of 54 former APC students (40.74 percent) took the AP exam. *Table 12* shows the distribution of results obtained in the exam, as well as the mean (2.722) and the standard deviation (1.235). A score of 3 is usually considered as a satisfactory one. The combined percentage of students who obtained a score of 3, 4 or 5 was 61.11.

TABLE 12

RESULTS OBTAINED IN AP EXAMS

	1	2	3	4	5	TOT.	Mean	St. De.
AP Calculus							2.722	1.235
Frequencies	12	9	20	8	5	54		
Percentages	22.22	16.67	37.04	14.81	9.26	100.00		

1: The lowest score; 5: The highest score; 3: Minimum satisfactory score.

Reasons For Participating In ASTS Mathematics Courses

The variable *Reasons for participating in ASTS mathematics courses* was measured with a six-point scale, in which "1" was "Most important," and "6" "Least important." Students rated a set of reasons which were classified in four groups. The

grouping of indicators was for interpretation purposes, and will be discussed in a later section. *Table 13* presents the mean and standard deviation of the ratings for each reason, for both courses.

TABLE 13

REASONS FOR PARTICIPATING IN ASTS MATHEMATICS COURSES

	AP Calculus			Trig./A. Geometry		
REASONS	Cases	Mean	St. De.	Cases	Mean	St. De.
Group 1						
Only way to take the course	136	2.721	1.896	86	3.302	1.910
Group 2						
Planned to take AP exam	135	3.948	1.882	--	--	--
Wanted to prepare for college	137	1.613	1.031	87	1.575	0.772
Wanted to get an idea about how a collegecourse would be	136	2.419	1.391	88	2.080	1.186
Group 3						
Encouraged by my teacher	135	2.815	1.546	87	2.586	1.667
Was forced to take the course	135	5.363	1.273	86	5.291	1.494
Group 4						
Was a personal challenge	137	2.394	1.325	88	2.250	1.225
Wanted to experience a TV course	136	4.449	2.738	86	3.488	1.890

For both courses, the reason rated as the most important was "I wanted to prepare for college" (mean = 1.613 for APC, and 1.575 for TAG) while the reason rated as least important was "I was forced to take the course" (mean = 5.363 for APC and 5.291 for

TAG). Although AP Calculus is an advanced placement course, the mean for "I planned to take an AP exam" was 3.948.

Evaluation Of The Experience

The variable *Evaluation of the experience* included eight indicators: seven referred to specific elements of the ASTS distance education model and the eighth was an *Overall* evaluation. Students rated each item using a five-point scale, in which "1" was "Very good," "5" "Very poor," and the mid-point was "Fair." The overall evaluation used a five-point scale in which "1" was "Very satisfactory," "2" "Satisfactory," "3" "Uncertain," "4" "Unsatisfactory," and "5" "Very unsatisfactory." *Table 14* presents the mean and standard deviation of the ratings for each item, for both courses.

TABLE 14

EVALUATION OF THE EXPERIENCE AT THE STUDENT LEVEL

	AP Calculus			Trig./A. Geometry		
EVALUATION ITEMS	Cases	Mean	St. De.	Cases	Mean	St. De.
Quality of written materials	138	1.703	0.796	91	1.758	0.899
Teaching partner performance	138	1.913	1.181	91	2.088	1.112
Relevance of course contents	137	1.723	0.838	91	1.978	0.843
OSU professor performance	138	2.014	1.101	91	1.890	1.110
Access to OSU professor and staff	135	1.933	0.964	91	2.275	1.096
Quality of television broadcasts	138	2.094	0.988	91	1.890	0.888
Knowledge of the subject (Calculus or Trig./A. Geom.) after taking the course	138	2.022	1.000	91	2.275	1.012
Overall evaluation	138	1.891	0.094	91	2.066	0.987

1: "Very good - Very satisfactory;" 5: "Very poor - Very unsatisfactory."

The means for all the items, including the overall evaluation, were around 2 ("Good" or "Satisfactory"). The lowest values --which came closest to approaching a "very good" or "very satisfactory" rating-- were, in both courses, for "Quality of written materials" (1.703 for APC, and 1.758 for TGA). The higher values --which fell between "good or satisfactory" or "uncertain"--were, for APC, 2.094 ("Quality of television broadcasts") and for TAG 2.275 (both "Access to OSU professor and staff," and "Knowledge of the subject after taking the course"). APC overall evaluation was better than TGA overall evaluation (1.891 and 2.066, respectively).

Table 15 presents the distribution of frequencies and percentages for the overall evaluation. The combined percentages of students who rated the experience using categories "1" or "2" were, for APC, 82.61 percent, and for TAG, 79.12 percent. However, while in the APC group categories "1" and "2" obtained almost the same percentage (40.58 and 42.03), TAG students preferred category 2 (50.55 percent) over category 1 (28.57 percent).

TABLE 15

OVERALL EVALUATION FREQUENCY
DISTRIBUTION AT THE STUDENT LEVEL

	1	2	3	4	5	TOTAL
AP Calculus						
Frequencies	56	58	10	11	3	138
Percentage	40.58	42.03	7.25	7.97	2.17	100.00
Trig./A. Geom.						
Frequencies	26	46	8	9	2	91
Percentage	28.57	50.55	8.79	9.89	2.20	100.00

Categories: 1: "Very satisfactory," 2: "Satisfactory," 3: "Uncertain," 4: "Unsatisfactory," 5: "Very unsatisfactory."

Descriptive Statistics At The Teaching Partner Level

Perception Of The Experience As A Professional Development Opportunity

Using a five-point scale, teaching partners showed their level of agreement/disagreement with the statement "AP Calculus (or Trigonometry/Analytic Geometry) By Satellite has been a good professional development opportunity for me." *Table 16* includes the distribution of frequencies and percentages, according to the five possible values of the scale, and the mean and standard deviation, considering the scale as a score measurement.

The means for both groups were slightly different: 2.154 for TAG, and 2.294 for APC. A higher percentage of TAG teaching partners (76.93 percent) selected categories "1" or "2," with respect to APC teaching partners (64.71 percent).

TABLE 16

EVALUATION OF THE EXPERIENCE AS A PROFESSIONAL DEVELOPMENT OPPORTUNITY

	1	2	3	4	5	TOT.	Mean	St. De.
AP Calculus							2.294	1.006
Frequencies	11	22	11	6	1	51		
Percentages	21.57	43.14	21.57	11.76	1.96	100.00		
Trig./A. Geom.							2.154	0.987
Frequencies	3	7	1	2	0	13		
Percentages	23.08	53.85	7.69	15.38	0.00	100.00		

Categories: 1: "Strongly agree;" 2: "Agree;" 3: "Uncertain," "4: Disagree," and 5: "Strongly disagree."

Satisfaction With Currently Being A Teaching Partner

Those who are currently teaching partners rated the experience of being a teaching partner, using a five-point scale. *Table 17* presents the distribution of frequencies and percentages, and the mean and standard deviation, considering the scale as a score measurement.

TABLE 17

SATISFACTION WITH CURRENTLY BEING A TEACHING PARTNER

	1	2	3	4	5	TOT.	Mean	St. De.
AP Calculus							1.815	0.921
Frequencies	12	10	3	2	0	27		
Percentages	44.44	37.04	11.11	7.41	0.00	100.00		
Trig./A. Geom.							1.600	0.548
Frequencies	2	3	0	0	0	5		
Percentages	40.00	60.00	0.00	0.00	0.00	100.00		

Categories: 1: "Very satisfactory," 2: "Satisfactory," 3: "Uncertain," 4: "Unsatisfactory," 5: "Very unsatisfactory."

For APC, 15 persons reported currently being a teaching partner, with a satisfaction mean of 1.815; 81.48 percent of respondents selected either category "1" or category "2." For TAG, the mean for the five respondents was 1.600, and 100 percent of them selected one of the first two categories.

Evaluation Of The Experience

The variable *Evaluation of the experience* included eight indicators: seven referred to specific elements of the ASTS distance education model and the eigth was an overall evaluation. The set was similar to the one used at the student level, with the exception of the item referring to teaching partners: Instead of "Teaching partner performance," in this case the item was "Teaching partner training." Teaching partners rated each item using a five-point scale, in which 1 was "Very good," 5 "Very poor," and the mid-point was "Fair." The overall evaluation used a five-point scale in which 1 was "Very satisfactory," 2 "Satisfactory," 3 "Uncertain," 4 "Unsatisfactory," and 5 "Very unsatisfactory." *Table 18* presents the mean and standard deviation of the ratings for each item, for both courses.

TABLE 18

EVALUATION OF THE EXPERIENCE AT THE TEACHING PARTNER LEVEL

	AP Calculus			Trig./A. Geometry		
EVALUATION ITEMS	Cases	Mean	St. De.	Cases	Mean	St. De.
Quality of written materials	51	1.519	0.644	14	1.500	0.519
Teaching partner training	51	2.204	1.000	12	2.250	1.055
Relevance of course contents	50	1.340	0.479	14	1.571	0.514
OSU professor performance	51	1.353	0.559	14	1.571	0.646
Access to OSU professor and staff	51	1.510	0.857	14	1.429	0.756
Quality of television broadcasts	51	1.588	0.779	14	1.643	0.633
Knowledge of the subject (Calculus or Trig./A. Geom.) after taking the course	47	2.000	0.834	14	1.929	0.730
Overall evaluation	50	1.540	0.813	14	1.857	0.864

1: "Very good - Very satisfactory;" 5: "Very poor - Very unsatisfactory."

"Teaching partner training" was the item that obtained the less favorable rating (2.204 for APC, and 2.250 for TGA) though it was close to the "Good" or "Satisfactory" levels. Other than APC teaching partners' 2.000 rating of "Knowledge of the subject," the rest of the items received mean ratings below 2, close to a "very good" or "very satisfactory" rating. For the APC group, "Relevance of course contents," and "OSU professor performance" were the items with the lowest means: 1.340 and 1.353, respectively. For the TAG group, the lowest mean was for "Access to OSU professor and staff." APC overall evaluation was better than TGA overall evaluation (1.540 and 1.850, respectively).

TABLE 19

OVERALL EVALUATION FREQUENCY DISTRIBUTION AT THE TEACHING PARTNER LEVEL

	1	2	3	4	5	TOTAL
Ap Calculus						
Frequencies	31	13	4	2	0	50
Percentage	62.00	26.00	8.00	4.00	0.00	100.00
Trig./A. Geom.						
Frequencies	5	7	1	1	0	14
Percentage	35.71	50.00	7.14	7.14	0.00	100.00

Categories: 1: "Very satisfactory," 2: "Satisfactory," 3: "Uncertain," 4: "Unsatisfactory," 5: "Very unsatisfactory."

Table 19 (page 55) presents the distribution of frequencies and percentages for the overall evaluation. The combined percentages of teaching partners who rated the experience using categories "1" or "2" were, for APC, 88.00 percent, and for TAG, 85.65 percent. In the APC group, categories "1" and "2" obtained 62.00 and 26.00, respectively; meanwhile, in the TAG group, the preference was the inverse: 35.71 percent for category "1," and 50.00 percent for category "2."

Descriptive Statistics At The School Administrators Level

Perception Of The Experience As A Help To Improve The Mathematics Curriculum At The School

School administrators expressed their level of agreement/disagreement with the statement "AP Calculus (or Trigonometry/Analytic Geometry) By Satellite has helped this school to improve its mathematics curriculum." The scale used for the rating had five points: From 1: "Strongly agree," to 5: "Strongly disagree." *Table 20* (next page) includes the distribution of frequencies and percentages, and the mean and standard deviation.

The means for both groups were slightly different: 2.226 for APC, and 2.333 for TAG. Regarding the APC group, 64.52 percent selected either category "1" or "2" and 22.58 percent selected category "3" ("Uncertain"). In the TAG group, 50 percent of the respondents selected category "2" and 41.67 percent category "3."

Number Of Non-Currently Participating Schools That Currently Have Former Teaching Partners Teaching Mathematics

Table 21 (next page) shows the number of non-currently participating schools that currently have former teaching partners teaching mathematics. While 38.71 percent of APC schools (12 schools) reported currently have former teaching partners teaching mathematics, only one TAG school (9.09 percent) reported this.

TABLE 20

EVALUATION OF THE EXPERIENCE AS A HELP TO IMPROVE THE MATHEMATICS CURRICULUM AT THE SCHOL

	1	2	3	4	5	TOT.	Mean	St. De.
AP Calculus							2.226	1.175
Frequencies	10	10	7	2	2	31		
Percentages	32.26	32.26	22.58	6.45	6.45	100.00		
Trig./A. Geom.							2.333	0.424
Frequencies	1	6	5	0	0	13		
Percentages	8.33	50.00	41.67	15.38	0.00	100.00		

Categories: 1: "Strongly Agree;" 2: "Agree;" 3: "Uncertain," "4: Disagree," and 5: "Strongly disagree."

TABLE 21

NON-CURRENTLY PARTICIPATING SCHOOLS THAT CURRENTLY HAVE FORMER TEACHING PARTNERS

	Yes	No	Don't know	TOTAL
AP Calculus				
Frequencies	12	18	1	31
Percentages	38.71	58.06	3.23	100.00
Trig./A. Geom.				
Frequencies	1	10	0	11
Percentages	9.09	90.91	0.00	100.00

Evaluation Of The Experience

The variable *Evaluation of the experience* was measured exactly in the same way that it was measured at the teaching partner level. *Table 22* presents the mean and standard deviation of the ratings for each item, for both courses.

For the APC group, only one item obtained a mean over 2: "Knowledge of the subject after taking the course," with a mean of 2.036. The item that obtained the lowest score --and therefore the most favorable rating-- was "OSU professor performance," with a mean of 1.536. For the TAG group, four items obtained means over 2: "Teaching partner training" (2.800), "Access to OSU professor and staff" (2.778), "Knowledge of the subject after taking the course" (2.556), and the overall evaluation (2.083). APC overall evaluation was better than TGA overall evaluation (1.667 and 2.083, respectively).

TABLE 22

EVALUATION OF THE EXPERIENCE AT THE SCHOOL LEVEL

	AP Calculus			Trig./A. Geometry		
EVALUATION ITEMS	Cases	Mean	St De.	Cases	Mean	St. De.
Quality of written materials	28	1.571	0.634	9	1.889	0.928
Teaching partner training	27	1.963	0.854	10	2.800	1.398
Relevance of course contents	28	1.571	0.790	9	1.778	0.667
OSU professor performance	28	1.536	0.693	9	1.889	1.054
Access to OSU professor and staff	27	1.593	0.747	9	2.778	1.202
Quality of television broadcasts	27	1.926	1.035	9	1.778	0.833
Knowledge of the subject (Calculus or Trig./A. Geom.) after taking the course	28	2.036	0.838	9	2.556	1.130
Overall evaluation	30	1.667	0.758	12	2.083	0.669

1: "Very good - Very satisfactory;" 5: "Very poor - Very unsatisfactory."

Table 23 presents the distribution of frequencies and percentages for the overall evaluation. The combined percentages of school administrators who rated the experience using categories "1" or "2" were, for APC, 90.00 percent, and for TAG, 75.00 percent. In the APC group, categories "1" and "2" obtained 42.67 and 43.33 percent, respectively. In the TAG group, the preference distribution was less even: 16.67 percent for category "1," and 58.33 percent for category "2;" additionally, 25.00 percent selected category "3" ("Uncertain").

TABLE 23

OVERALL EVALUATION FREQUENCY
DISTRIBUTION AT THE SCHOOL LEVEL

	1	2	3	4	5	TOTAL
AP Calculus						
Frequencies	14	13	2	1	0	30
Percentage	46.67	43.33	6.67	3.33	0.00	100.00
Trig./A. Geom.						
Frequencies	2	7	3	0	0	12
Percentage	16.67	58.33	25.00	0.00	0.00	100.00

Categories: 1: "Very satisfactory," 2: "Satisfactory," 3: "Uncertain," 4: "Unsatisfactory," 5: "Very unsatisfactory."

A Model For Measuring The Effectiveness Of ASTS Mathematics Courses

Consistent with the theoretical framework discussed in Chapter I, this study was based on the assumption that distance education is --most of the time-- an alternative to

close the gap created by differences in access to conventional education, instead of an option competing for students against conventional education. The importance of clearly distinguishing between both approaches to distance education is evident, since the approach defines the objectives of distance education, and consequently, the way in which its effectiveness should be measured.

The "perfect substitute" approach to distance education suggests the objective of providing the same type of learning as conventional education but using different media. The effectiveness of a distance education program viewed from this perspective should be measured, therefore, by comparing the learning results of an experimental group --the one which participated in the distance learning program-- against the learning results of a control group --a group that took a similar course but in a conventional way. In order to draw valid conclusions in which causality could be assumed, every effort should be made to ensure the application of experimental research rules.

However, the "alternative" approach to distance education suggests a different type of objective, and consequently, of measurement of effectiveness. With the objective of providing access to education to those who do not have access to conventional education, the experimental approach to the measurement of effectiveness is simply impossible, since there is no way to have a control group. Thus, a different model for measuring effectiveness must be used. Since it would not be tested in an experimental setting, such a model could not be a causal one; instead, the model must be based on the interpretation of statistical data regarding a set of variables.

For the purposes of this thesis, a model for evaluating the effectiveness of ASTS mathematics courses was developed. The model interprets data collected by the survey regarding the variables previously described. To compensate for the lack of statistical causality, the model uses variables at three levels of analysis --student, teaching partner and school administrator-- and includes more than one variable for each level. Another

positive point of the model is that the information on which it is based was collected using a follow-up approach.

Four criteria were used to measure the effectiveness of ASTS mathematics courses:

One: For those variables using a five-point scale, at least 75 percent of the responses should be distributed between values "1" and "2;" or the mean rating must be equal to or smaller than 2.00. The rationale for this criteria is that values 1 and 2 mean "Very satisfied/Very good," and "Satisfied/Good," respectively. Thus, if the mean is within these two levels --or 75 percent of responses-- a general idea of satisfaction can be assumed.

The variables affected by this criterion are, at the student level: *Perceived degree of preparedness to take college-level mathematics courses* (both indicators); and *Evaluation of the experience* (the seven items and the overall evaluation). At the teaching partner level, the variables affected are: *Perception of the experience as a professional development opportunity*; *Satisfaction with currently being a teaching partner*; and *Evaluation of the experience* (the seven items and the overall evaluation). At the school administrators level, the variables affected are: *Perception of the experience as a help to improve the mathematics curriculum at the school;* and *Evaluation of the experience* (the seven items and the overall evaluation).

Two: Regarding APC students, a minimum of 70 percent of those former students who took the AP Calculus exam should obtain a score of 3 or more. According to the College Entrance Examination Board (1956) the scores should be read in the following way: "5 (highest honors), 4 (honors), 3 (creditable), 2 (pass), and 1 (fail)." A success rate of 70 percent seems to be reasonable for a course measured by a national standardized test.

Three: For the variable *Reasons for participating in ASTS mathematics courses*, in which a six-point scale was used, groups 1 and 2 should obtain a maximum mean of 2.3, while groups 3 and 4 should obtain a minimum mean of 4.7.

If items pertaining to groups 1 and 2 were selected as "important" reasons for participating in ASTS mathematics courses, it could mean that ASTS courses were seen as an alternative to conventional education. On the other hand, if items pertaining to groups 3 and 4 were selected as "important" it would mean that ASTS was selected for reasons not related to the alternative nature of distance education. That is why these two groups of reasons should obtain a mean equal to or larger than 4.7.

The reasons that should obtain a maximum mean of 2.3 were: from group 1 (reasons related to availability of options), "It was the only way I could take a calculus -- or trigonometry/analytic geometry-- course;" and from group 2 (reasons related to college preparation), "I planned to take an AP exam," "I wanted to prepare for college," and "I wanted to get an idea about how a college course would be." The reasons that should obtain a minimum mean of 4.7 were: from group 3 (reasons related to external motivation), "My teacher encouraged me to take the course," and "I was forced to take the course;" and from group 4 (reasons related to individual preferences), "It was a personal challenge," and "I wanted to experience a television course."

Four: A minimum of 50 percent of non-currently participating schools should have former teaching partners employed as mathematics teachers. This criterion emphasizes the importance of ASTS courses as development opportunities for high school mathematics teachers. If such a minimum is obtained, it might help to explain the low return rates for schools participating in ASTS mathematics courses.

Evaluation Of The Effectiveness Of ASTS Mathematics Courses

This section relates the findings described in the first part of the chapter to the model for measuring the effectiveness of ASTS mathematics courses proposed in the section above.

Effectiveness Of ASTS Mathematics Courses At The Student Level

Mixed results were found after applying the effectiveness criteria to the findings at the student level. However, there was more evidence supporting a conclusion that the courses were effective than evidence supporting a negative conclusion.

Approximately 92 percent of former APC students are attending college, and the percentage for TAG (86 percent) is also over 48 percent, which is the reported percentage of recent high school graduates nation-wide who attended college during the Fall of 1988 (Research Associates of Washington 1991). In addition,the college GPA of former students was above 3.00, the usual minimum standard used by many universities to admit new students to graduate programs: 3.34 for APC, and 3.11 for TAG. Therefore, it can be concluded that the vast majority of former ASTS mathematics students are not only attending college, but they are doing well in their studies.

Former students were asked how well prepared they were to take college-level mathematics courses. Using the criterion of "mean equal to or lower than 2," since this variable was measured using a five-point scale, it was found that APC former students reported being adequately prepared to take college-level mathematics courses (mean of 1.52), and rejected the idea of being at a disadvantage with respect to other students (mean of 1.79). However, TAG former students' results were not sufficient to meet the

criterion: their means were 2.05 and 2.139, respectively. Still, the means were very close to the maximum standard of 2.

Taking an ASTS mathematics course in high school --as an isolated variable-- cannot account for the level of preparedness to take college-level courses the students reported. Nevertheless, since the courses were part of their preparation in mathematics during high school, especially in advanced subjects like calculus and trigonometry/analytic geometry, ASTS courses may be seen as contributors to the perceived level of preparedness reported by former students.

Forty percent of former students took the AP Calculus AB exam, obtaining a mean of 2.722; 61.11 percent of them scored 3 or higher on the exam. Both the mean and the percentage of students obtaining 3 or more were below the minimum proposed for this study as a measure of effectiveness of the ASTS courses. However, this percentage was close to the minimum of 70 percent, and also close to the 67 percent reported by Choike (in Holt 1991) in a previous study of former APC students' performance in the AP exam.

Regarding the reasons for participating in ASTS mathematics courses, the findings provide mixed results. Groups of reasons 1 and 2 --related to availability of options and college preparation-- were expected to obtain high levels of importance, while low levels were expected for groups 3 and 4 --related to external motivation and personal interest. Though close to the maximum mean of 2.3, the first group obtained a mean of 2.7 for APC. For TAG, the mean was even farther from the maximum: 3.3. The difference between both courses may be explained by the fact that it is more common for high schools to offer a trigonometry/analytic geometry course than an AP calculus course. However, the difference with respect to the standard --even a small one-- reflects a perception that for many students, ASTS courses were not necessarily the only option available to take advanced mathematics courses.

Regarding group 2, all the reasons obtained scores below the maximum of 2.3, with the exception of "I wanted to take an AP exam," that applied only to APC students. "I wanted to prepare for college" was the most important reason for taking both APC and TAG. Nevertheless, it was interesting to find the mean of 3.94 for "I wanted to take an AP exam," since contrary to what was expected, it showed that, for many students, preparing for an AP exam was not an important reason to take APC. This finding helps to explain why only 40 percent of former students took the AP exam.

Groups 3 and 4 mostly showed negative results, in terms of the effectiveness criteria. As expected, "I was forced to take the course" was not a clear reason to participate (means of 5.36 for APC and 5.29 for TAG). However, two of the three remaining reasons ("My teacher encouraged me to take the course" and "It was a personal challenge") obtained means of approximately 2.5 for both groups. Although not a strong reason (means of 4.44 and 3.48), "I wanted to experience a television course" did not meet the minimum mean of 4.7. External motivation and individual preferences were expected to be of small importance, if the idea that students take ASTS courses mainly as an alternative to conventional education were true. Still, the influence of high school teachers and the personal challenge nature of the decision to participate in ASTS mathematics courses contribute to a better understanding of ASTS students.

Regarding the evaluation of the experience, APC former students rated six out of eight items of the variable with means inside the "satisfactory" range (equal to or below 2). TAG students rated five items inside this range, but the *Overall* evaluation was one of the three elements with a mean outside the range (mean of 2.066). Yet, for both groups none of the items obtained a mean larger than 2.3, which makes it reasonable to conclude that, in general, former ASTS mathematics students were satisfied with their experience with the courses.

Effectiveness Of ASTS Mathematics Courses At The Teaching Partner Level

Results were also mixed at the teaching partner level, but in general the evaluation was more positive than negative. The perception of the experience of being a teaching partner as a good professional development opportunity did not meet the criteria of effectiveness for APC (mean of 2.29) but it did for TAG (77 percent of responses were within categories "1" or "2").

Besides teaching high school students, ASTS courses are training opportunities for the teaching partners, since it is expected that they will be able to teach the same course by themselves after one or more years of being teaching partners. However, according to the results, the experience was not clearly perceived as a good professional development opportunity, even by TAG teaching partners, since the mean for them was 2.15.

Nevertheless, the teaching partners from both APC and TAG reported a clear level of satisfaction (means of 1.81 and 1.60 respectively) with the experience of being a teaching partner. Additionally, for both courses, seven out of eight items of the *Evaluation of the experience* variable were rated with means equal to or below 2.0. The only item that obtained a non-satisfactory rating was, precisely, "Teaching partner training."

Effectiveness Of ASTS Mathematics Courses At The School Level

The results at the school level are slightly less favorable than those at the student and teaching partner levels. The perception of the experience as a help to improving the mathematics curriculum at the high school did not meet the criteria of effectiveness, neither for APC (mean of 2.22) nor for TAG (mean of 2.33).

ASTS mathematics courses are supposed to help high schools to improve their mathematics curriculum, first by offering courses that the schools could not teach with their current human resources, and second, by training teachers to teach advanced courses in the future. Though not very far from the standard, the means for this variable did not reflect a clear perception of ASTS courses by school administrators as the kind of help they are supposed to be.

Another criterion of effectiveness at this level was the proportion of non-currently participating schools having former teaching partners employed as mathematics teachers. According to the criterion, the percentage of such schools should be 50 or more, but the results were far from that number: about 38 percent of former APC participating schools reported having former teaching partners teaching mathematics, while the percentage for TAG was nine. Thus, it can be concluded that --in general-- ASTS is not fulfilling its objective of helping high schools to improve their mathematics curriculum by training mathematics teachers who remain in the school.

The *Evaluation of the experience* variable obtained better results. For APC, seven out of eight items were rated with means below 2.0. For TAG, the number of items was five out of eight. It is interesting that for both APC and TAG the item "Knowledge of the subject after taking the course" obtained means above 2 (2.036 and 2.556 respectively).

Overall Evaluation

According to the results obtained for the variables, and applying the criteria proposed to evaluate the effectiveness of ASTS mathematics courses as an alternative to conventional education, the following conclusions can be stated.

First, although not all the criteria were met, the tendency was to be close to the proposed standards. Second, the programs seem to be successful in contributing to an adequate preparation of high school students to attend college successfully . Third, though teaching partners and school administrators generally were satisfied with their

participation in ASTS mathematics courses, ASTS seemed not to clearly fulfill its objective of being a professional development opportunity for high school mathematics teachers. Fourth, students reported enrolling in the courses to prepare for college, but they did not clearly see ASTS courses as the only way to participate in advanced mathematics courses in high school. Therefore, the assumption that distance education is mainly seen as an alternative to conventional education --with conventional as *mainstream*--was not supported by the results.

Identifying Factors Statistically Related To The Evaluation Of ASTS Mathematics Courses

This section describes and discusses the results related to the second objective of the study: To identify factors statistically related to the evaluation of ASTS mathematics courses. Data were used to test the statistical hypotheses proposed in Chapter III.

Analysis Of Correlation

Correlation Coefficients

An analysis of correlation was conducted to measure the relationship between each of the seven specific items included in the *Evaluation of the experience* variable, and the overall evaluation. *Table 24* (next page) shows the Pearson *r* correlation coefficients for each item with respect to the overall evaluation. Column "TOTAL" shows the coefficients obtained after running the analysis taking the six groups as just one group. The other columns present the coefficients for specific groups. Sample size (n) is included, as well as the minimum significant *r* coefficient at the 95 percent level of confidence, according to the degrees of freedom (n-2).

TABLE 24

PEARSON R CORRELATION COEFFICIENTS
BETWEEN EVALUATION ITEMS AND OVERALL
EVALUATION

ITEMS	TOTAL	APC ST.	APC TP.	APC SCH.	TAG ST.	TAG TP.	TAG SCH.
Quality of written materials	0.480	0.471	0.431	0.265	0.519	0.417	0.572
Teaching partner performance - training	*	0.194	0.609	0.421	0.521	0.361	0.858
Relevance of course contents	0.579	0.626	0.409	0.624	0.496	0.458	0.795
OSU professor performance	0.653	0.630	0.574	0.610	0.737	0.390	0.503
Access to OSU professor and staff	0.479	0.330	0.339	0.445	0.651	0.410	0.735
Quality of TV broadcasts	0.499	0.465	0.485	0.806	0.516	0.438	0.424
Knowledge of the subject after taking the course	0.723	0.733	0.550	0.665	0.783	0.590	0.938
Sample size	338	138	51	31	91	15	12
Minimum significant r (P = 0.05)	0.113	0.159	0.273	0.355	0.205	0.514	0.938

** It does not apply, since it varied according to the groups: Students rated "TP performance," while the other groups rated "TP training."*

Discussion Of Correlation Coefficients

If larger than the minimum significant coefficient at the 95 percent level of confidence, *r* coefficients were interpreted according to the following criteria: A coefficient between .40 and .69 was considered a "moderate relationship," a coefficient

between .70 and .89 a "moderately strong relationship," and a coefficient equal to or larger than .90, a "strong relationship." With the exception of six coefficients smaller than .40, the items seemed --in general-- to be related to the overall evaluation. Therefore, *null hypothesis 1* ("There is no relationship between each of the items of the variable *Evaluation of the experience* and the overall evaluation") was rejected for all the cases except those with a coefficient level smaller than 0.40.

Some items showed more consistency throughout all the groups than others. It was found that "Knowledge of the subject after taking the course" was the item with the stronger relationship for the whole group (0.723) and with the most consistent strength at each group (the lowest coefficient was 0.550, and the highest 0.938). Two other items showed a relationship pattern with overall evaluation, but not as consistent as "Knowledge. . ." : "Relevance of course contents," and "OSU professor performance." "Quality of written materials" consistently exhibited the weakest correlation to overall evaluation.

This pattern of relationships explains, for example, why although the overall evaluation of the experience by APC students was 1.891, the OSU professor performance was rated 2.014, and while TAG students rated the overall experience a 2.066, the OSU professor was rated 1.890.

Analysis Of Variance

Analysis Of Variance Results

Analysis of variance (ANOVA) was used to test whether there were differences in the *Overall* evaluation that could be explained by the variables *Gender*, *Course* (APC or TAG), and *Level* (student, teaching partner, or school administrator). The variable *Gender* was tested only with the student group. Two analysis were conducted: One, a two-factor ANOVA for the whole sample, including *Overall* evaluation as the dependent variable,

and *Course* and *Level* as categorical variables.; and two, a two-factor ANOVA for the student level, including *Overall* evaluation as the dependent variable, and *Gender* and *Course* as categorical variables,

Table 25 shows the breakdown of *Overall* evaluation means by *Course* and *Level*, as well as the results of the ANOVA test. The variable *Course* was significant as a main effect at the 95 percent level of confidence. No significant results ($P < 0.05$) were found for the variable *Level*, or the interaction of both independent variables.

Table 26 (next page) shows the breakdown of Overall evaluation means by *Course* and *Gender* at the student level, as well as the results of the ANOVA test. No significant ($P < 0.05$) main effects or interaction of variables were found.

TABLE 25

OVERALL EVALUATION BY GROUP AND COURSE

	Students	Teaching Part	School admin.	TOTAL
AP Calculus	1.891	1.540	1.536	1.780
Trig./A. Geom.	2.066	1.854	2.083	2.043
TOTAL	1.961	1.609	1.786	1.872

Analysis of variance: N: 335. Multiple R: 0.190.
Course: F-Ratio = 4.184; P = 0.042. Group: F-Ratio = 1.698; P = 0.185.
*Course*Group: F-Ratio = 0.314; P = 0.731.*

Discussion Of Analysis Of Variance Results

The results of the two ANOVA tests did not allow to reject the *null hypothesis 2* ("There is no difference in results for the overall *Evaluation of the Experience*, by

Gender, *Course*, and *Level* -- *Gender* at the student level only "), except for the variable *Course* when analyzing all three groups of respondents combined. Accordingly, it may be said that, overall and with a 95 percent level of confidence, AP Calculus By Satellite was rated more favorable (1.780) than Trigonometry/Analytic Geometry By Satellite (2.043).

TABLE 26

OVERALL EVALUATION BY GENDER AND COURSE
(STUDENT LEVEL ONLY)

	Female	Male	TOTAL
AP Calculus	1.783	1.909	1.834
Trig./A. Geom.	2.203	1.806	2.074
TOTAL	1.950	1.876	1.922

Analysis of variance: N: 258. Multiple R: 0.170.
Course: F-Ratio = 1.408; P = 0.236.
Gender: F-Ratio = 1.030; P = 0.311.
*Course*Gender: F-Ratio = 3.823; P = 0.052.*

Demographic Profile Of Participants in ASTS Mathematics Courses

This section describes and discusses the results related to the third objective of the study: To build a demographic profile of participants in ASTS mathematics courses.

Demographic Data Of Former Students

Age

This variable was defined as the chronological age of former students at the time of answering the survey. A total of 137 former APC students answered the question, providing a mean of 18.131 years, with a standard deviation of 1.571. For TAG, there were 90 responses to the question, providing a mean of 19.067, with a standard deviation of 1.015.

Gender

Table 27 presents a breakdown of former APC and TAG students according to *Gender*. For APC, the percentage of females was 51.82, and for TAG, it was 65.17. These data were compared against the population, and the results of the comparison were described in the first part of this chapter.

TABLE 27

FORMER STUDENTS BY GENDER

	Frequencies			Percentages		
	Female	Male	Total	Female	Male	TOTAL
APC Students	71	66	137	51.82	48.18	100.00
TAG Students	58	31	89	65.17	34.83	100.00

High School GPA

This variable was defined as the high school grade point average (GPA) reported by the student. Generally, GPA is measured on a scale in which 4.00 is the highest value. However, some students reported a GPA higher than 4.00, explaining that it was possible because their high schools had the policy of "weighting" some courses --ASTS courses, among others. A total of 135 former APC students answered the question, providing a mean of 3.703, with a standard deviation of 0.392. For TAG, there were 90 responses to the question, providing a mean of 3.702, with a standard deviation of 0.305.

High School Class Ranking

Table 28 presents the distribution of former APC and TAG students according to *High school class ranking*. For APC, 93.33 of respondents graduated from high school ranking in the top 20 percent of their class. For TAG, the percentage of students who ranked in the top 20 percent was 95.56. None of the respondents from either group reported having ranked in the lowest 40 percent of their high school class.

TABLE 28

FORMER STUDENTS HIGH SCHOOL CLASS RANKING

	Top 20%	2nd 20%	Mid 20%	4th 20%	Low 20%	TOTAL
AP Calculus						
Frequencies	126	6	3	0	0	135
Percentage	93.33	4.44	2.22	0.00	0.00	100.00
Trig./A. Geom.						
Frequencies	86	2	2	0	0	90
Percentage	95.56	2.22	2.22	0.00	0.00	100.00

Type Of Job

For APC, 43.79 percent of former students reported currently having a job; the percentage for TAG respondents was 52.22. *Table 29* shows the type of job held by these former students. Most of those former students who reported currently having a job had a part-time job (83.33 for APC and 80.43 for TAG).

TABLE 29

FORMER STUDENTS TYPE OF JOB

	Part time	Full time	Own business	TOTAL
AP Calculus				
Frequencies	50	10	0	60
Percentages	83.33	16.67	0.00	100.00
Trig./A. Geom.				
Frequencies	37	7	2	46
Percentages	80.43	15.22	4.35	100.00

Colleges Attended By Former Students

Table 30 (next page) lists the colleges that are attended by former APC students. The list includes the number of students who reported attending each college. A total of 82 schools and colleges were named. Twelve universities or colleges were named two or more times; the University of Alabama at Birmingham was the most frequently named, with 10 frequencies.

TABLE 30

COLLEGES ATTENDED BY FORMER AP CALCULUS STUDENTS

College Or University	Freq.
University of Alabama at Birmingham.	10
Auburn University.	5
Pennsylvania State University.	5
Wallace Community College - Selma.	4
Marshall University.	3
Oklahoma State University.	3
University of Montevallo.	3
University of Oklahoma.	3
Carnegie Mellon University.	2
Hiwassee College.	2
Indiana University of Pennsylvania.	2
Jefferson State Junior College.	2
Murray State University.	2
Northeastern Oklahoma State University.	2
Samford University.	2
University of Alabama at Tuscaloosa.	2
University of Missouri - Rolla.	2
University of Pittsburgh.	2
University of Toledo.	2
Vanderbilt University.	2
West Virginia University.	2
West Virginia Wesleyan College.	2
Alabama State University.	1
Alice Joyce College.	1
Birmingham Southern College.	1
Bucknell University.	1
Carl Albert State College.	1
Case Western Reserve University.	1
Central Michigan University.	1
Cleveland State Community College.	1

TABLE 30 (Continued)

College Or University	Freq.
Colorado State University	1
Columbus College	1
Darthmouth College.	1
De Paul University.	1
East Tennessee State University.	1
Florida Institute of Technology.	1
Fort Hays State University.	1
Front Range Community College.	1
Gannon University	1
Grove City College.	1
Juniata College.	1
Kansas State University.	1
Livingston University.	1
Lycoming College.	1
Malone College.	1
Maryville University.	1
Miami University.	1
Mineral Area College.	1
Missouri Southern State College.	1
Moravian College,	1
Northeastern Oklahoma A and M College.	1
Northern Oklahoma College.	1
Northwest Missouri State University.	1
Ohio Northern University.	1
Ohio University.	1
Oklahoma City University.	1
Otterbein College.	1
Princeton University.	1
Purdue University.	1
Saint Louis College of Pharmacy.	1
Saint Louis University.	1
Snead State Junior College.	1
Southeast Missouri State University.	1

TABLE 30 (Continued)

College Or University	Freq.
Southern West Virginia Community College.	1
Southwestern Oklahoma State University.	1
Tennessee Tech University.	1
Tulane University	1
University of Central Oklahoma.	1
University of Colorado at Boulder	1
University of Dayton.	1
University of Illinois at Champaign-Urbana.	1
University of Missouri-Columbia.	1
University of Missouri-Kansas City.	1
University of Nebraska.	1
University of Notre Dame.	1
University of Pittsburgh at Johnstown.	1
University of Tennessee.	1
Virginia Polytechnic Institute And State Univ.	1
Virginia Tech.	1
Wake Forest University.	1
Washington State University.	1
Yale University.	1

Table 31 (next page) lists the colleges that are attended by former TAG students. The list includes the number of students who reported attending each college. A total of 51 universities or colleges were included in the list. Sixteen universities or colleges were cited two or more times. Carl Albert State College and the University of Southern Mississippi tied as the most frequently named, with four mentions each.

TABLE 31

COLLEGES ATTENDED BY FORMER TRIGONOMETRY/ANALYTIC GEOMETRY STUDENTS

College Or University	Freq.
Carl Albert State College.	4
University of Southern Mississippi.	4
Alcorn State University.	3
East Central University.	3
Eastern Oklahoma State College.	3
Fort Hays State University.	3
Mineral Area College.	3
Rust College.	3
Southern West Virginia Community College.	3
University of Maine.	3
West Virginia University.	3
Alice Lloyd College.	2
Marshall University.	2
Oklahoma State University.	2
Southeastern Oklahoma State University.	2
Tougaloo College.	2
Alfred State.	1
Central Methodist.	1
Concord College.	1
Connors State College.	1
Delta State University.	1
East Mississippi Junior College.	1
Embry-Riddle Aeronautical University.	1
Emory University.	1
Hobart and William Smith Colleges	1
Indiana Institute of Technology.	1
Kansas State University.	1
Kenyon College.	1
Livingstone University.	1

TABLE 31 (Continued)

College Or University	Freq.
Mississippi Delta Community College.	1
Mississippi State University.	1
Missouri Baptist College.	1
National Education Center.	1
Northeastern A&M College.	1
Northwestern Oklahoma State University.	1
Northwestern University.	1
Oklahoma Panhandle State University.	1
Oral Roberts.	1
Paul Smith's College of Arts and Sciences.	1
Potomac State College.	1
Rochester Institute of Technology.	1
Southwestern Oklahoma State University.	1
Stillman College.	1
Suny Fredonia.	1
Tennessee State University.	1
Thomas College.	1
University of Mississippi.	1
University of Oklahoma.	1
University of Science and Arts of Oklahoma.	1
University of Vermont.	1
Westminster College.	1

Majors Of Former Students Attending College

Table 32 lists the academic areas in which those former APC students who attend college are majoring. The list includes the number of citations for each area. Forty-one different areas were included. Twenty-two areas were mentioned two or more times. Ten students reported being undecided. Accounting was the most mentioned area with ten

frequencies, followed by Business Administration and Pharmacy, tied with eight citations each.

TABLE 32

MAJORS OF FORMER AP CALCULUS STUDENTS ATTENDING COLLEGE

Area	Freq.
Undecided.	*10*
Accounting.	9
Business Administration.	8
Pharmacy.	8
Electrical Engineering.	7
Engineering.	7
Pre-Medicine.	7
Mechanical Engineering.	6
Chemical Engineering.	5
Chemistry.	5
Mathematics.	5
Aerospace Engineering.	4
English.	3
Architectural Engineering.	2
Biology.	2
Computer Programming.	2
Computer Science.	2
Education.	2
Finance.	2
Management Information Systems.	2
Pre-Dentistry.	2
Radiological Technology.	2
Actuarial Sciences.	1
Bio-Medical Engineering	1

TABLE 32 (Continued)

Area	Freq.
Civil Engineering.	1
Commerce.	1
Criminal Justice.	1
Economics.	1
Forestry.	1
History.	1
Industrial Management	1
Liberal Arts.	1
Marine Biology.	1
Mineral Engineering.	1
Nuclear Engineering.	1
Nursing.	1
Physics.	1
Pre-Business.	1
Pre-Optometry.	1
Speech Communication.	1
Vocal Performance.	1

TABLE 33

MAJORS OF FORMER TRIG./ANALYTIC GEOMETRYSTUDENTS ATTENDING COLLEGE

Area	Freq.
Computer engineering/computer science.	9
Nursing.	8
Business administration.	7
Biology-Premedical technology.	6
Accounting.	5
Elementary education.	3

TABLE 33 (Continued)

Area	Freq.
Pre-medicine.	3
Undecided.	*3*
Electronic engineering.	2
English.	2
Health Care Administration.	2
Math education.	2
Mathematics.	2
Mechanical engineering.	2
Physical Education.	2
Accounting/Computer Science.	1
Aerospace engineering.	1
Architectural design.	1
Art education.	1
Aviation.	1
Chemical Engineering.	1
Chemistry.	1
Computer information systems.	1
Engineering.	1
Forensic Science.	1
History.	1
Hotel and restaurant management.	1
Journalism.	1
Medical Technology.	1
Music education.	1
Nuclear Medicine.	1
Petroleum engineering.	1
Pharmacy.	1
Political Science.	1
Secondary education.	1
Social Work.	1
Wildlife Management.	1

Table 33 (page 82) lists the majors of former TAG students who are attending college. The list includes the number of citations received by each academic area. Thirty-seven different areas were mentioned. Fifteen areas were cited two or more times. Computer Engineering - Computer Science was the most selected area (nine citations), followed by Nursing with eight.

Demographic Data Of Former Teaching Partners

Age

A total of 51 former APC teaching partners answered the question regarding their age, providing a mean of 43.784 years, with a standard deviation of 9.317. For TAG, there were 14 responses to the question, providing a mean of 43.643, with a standard deviation of 7.281.

Gender

Table 34 (next page) presents a breakdown of former APC and TAG teaching partners by *Gender*. For APC, the percentage of females was 52.94, and for TAG, it was 42.86. These data were compared against the population, and the results of the comparison were described in the first part of this chapter.

Years Of Experience As Teachers

This variable was defined as the number of years employed as a teacher, as reported by the teaching partners. A total of 48 former APC teaching partners answered the question, providing a mean of 17.729 years, with a standard deviation of 8.986. For TAG, there were 13 responses to the question, for a mean of 16.692, with a standard deviation of 6.663.

TABLE 34

FORMER TEACHING PARTNERS S BY GENDER

	Frequencies			Percentages		
	Female	Male	Total	Female	Male	TOTAL
APC Teaching partners	27	24	51	52.94	47.06	100.00
TAG Teaching partners	6	8	14	42.86	57.14	100.00

TABLE 35

CERTIFICATION AS MATHEMATICS TEACHER

	Currently			First Year		
	Yes	No	TOT.	Yes	No	TOT.
AP Calculus						
Frequencies	45	6	51	44	7	51
Percentages	88.24	11.76	100.00	86.27	13.73	100.00
Trig. A. Geometry						
Frequencies	11	3	14	11	3	14
Percentages	78.57	21.43	100.00	78.57	21.43	100.00

Certification As Mathematics Teacher - Certification As Mathematics Teacher During The First Year He/She Was A Teaching Partner

Certification as mathematics teacher meant whether the teaching partner was currently a certified mathematics teacher. *Certification as mathematics teacher during the*

first year he/she was a teaching partner meant whether the person was a certified mathematics teacher during the first time he/she was a teaching partner. *Table 35* (page 35) describes the results of both variables.

Demographic Data Of Former Participating Schools

Table 36 includes information regarding the demographic variables measured at the school level. The variables are individually described under specific sub-titles.

TABLE 36

DEMOGRAPHIC VARIABLES OF FORMER PARTICIPATING SCHOOLS

	AP Calculus			Trig./A. Geom.		
	Cases	Mean	St. De.	Cases	Mean	St. De.
Number of students	31	605.22	464.91	12	186.08	172.06
Number of grades	31	4.129	1.056	12	3.750	0.452
Number of students taking mathematics courses	31	453.03	394.36	12	135.91	124.92
Number of certified mathematics teachers	31	4.806	2.937	12	2.250	1.215

Size Of Student Body

The average number of students attending the 31 high schools participating in APC that responded to the survey was 605.226, with a standard deviation of 464.918. For

the 12 TAG high schools, the mean and the standard deviation were smaller: 186.083 and 172.065, respectively.

Number Of Grades Offered In The High School

APC high schools offered a mean of 4.129 grades --levels-- with a standard deviation of 1.056, while TAG high schools offered a mean of 3.750 grades, with a standard deviation of 0.452.

Number Of Students Taking Mathematics Courses

The responses of APC high schools produced a mean of 453.032 students taking mathematics courses, with a standard deviation of 394.367. For TAG high schools, the mean was 135.917, with a standard deviation of 124.926.

Number Of Certified Mathematics Teachers Teaching
At The School

APC high schools reported a mean of 4.806 certified mathematics teachers teaching at the school, with a standard deviation of 2.937. TAG high schools reported a smaller mean of 2.250, with a standard deviation of 1.215.

Ratio Of The Number Of Mathematics Students To
Certified Mathematics Teachers

An additional variable was calculated in relation to two of the previously reported variables: number of mathematics students and number of certified mathematics teachers. The ratio of the number of mathematics students to certified teachers was 94.263 for APC, and 60.407 for TAG. This means that there are about 94 mathematics students for each certified mathematics teacher at APC high schools, and about 60 students for each certified teacher at TAG schools.

Building A Demographic Profile of Participants In ASTS Mathematics Courses

Using data presented in the three previous sections, a demographic profile of participants at the three levels was constructed.

Former APC and TAG students were, during the time of the study, about 18 and 19 years old, respectively. APC students were almost evenly split in terms of gender, but TAG students showed a higher proportion of females (65 percent). Former students graduated from high school mostly in the top 20 percent of their class, with an average GPA of 3.7. About half of former students currently had a job, mainly a part-time one. They were attending a variety of colleges and schools, majoring in a variety of academic areas. The list of colleges and universities attended by them includes both public and private institutions, some of national importance and some others more locally known. Though the list of majors was a long one, students seemed to concentrate in business, computer sciences, pharmacy, engineering and nursing.

Teaching partners from both APC and TAG averaged 43 years of age. However, while the students' age had a small variance, the teaching partner ages varied from the 20s to the 60s. About half of APC teaching partners were females, while about 40 percent of TAG teaching partners were females. The teaching partners had an average of 16 to 17 years of experience as teachers, also with a large variance. According to an ASTS policy, the teaching partners for mathematics courses should be certified teachers in mathematics. However, only 86 percent of APC and 78 percent of TAG teaching partners were certified mathematics teachers during the first year they assumed that responsibility, and only one of them had obtained a mathematics certification since that date.

Differences in size were reported for APC and TAG schools. On average, APC participant schools were three times larger than TAG schools, but offered almost the same number of grades. APC schools also had a larger number of students taking

mathematics courses, as well as more certified mathematics teachers. APC schools had about 94 mathematics students for each certified mathematics teacher, while the ratio for TAG schools was 60 to 1.

Summary

The results presented and discussed in this chapter were based on a total of 338 answered questionnaires out of a total of 892 questionnaires sent to the three groups under study, for an overall response rate of 37.89. This percentage was not with respect to a sample but to the whole population. To test the representativeness of the respondents, the sample was compared to the population in terms of gender, high school from which former students graduated, and state where former students attended high school. No significant differences were found and therefore, a certain level of representativeness of the sample was assumed.

Descriptive statistics were obtained for a set of variables related to the measurement of effectiveness in distance education, as proposed in previous chapters. A set of criteria to measure effectiveness was proposed and applied to the results. It was concluded that, in general, ASTS mathematics courses met the criteria or were close to meeting them. ASTS courses seemed especially helpful as preparation for high school students to attend college successfully. Although at the three levels --student, teaching partner and school administrator-- the evaluation of the ASTS experience was mostly within the "satisfactory" range, ASTS did not seem to be clearly perceived as a good professional development opportunity by teaching partners, nor a help to improving the mathematics curriculum at participating schools.

Correlation statistics were applied to the seven specific items of the *Evaluation of the experience* variable and the *Overall* evaluation. In general, all the items were statistically related to the overall evaluation, but it was "Knowledge of the subject after taking the course" that consistently showed a high relationship to the overall evaluation

throughout the levels. Also strongly related, but not as consistently, were "OSU professor performance" and "Relevance of course content."

An analysis of variance (ANOVA) showed statistically significant differences ($p = 0.05$) in the overall evaluation of APC and TAG. This means that, overall, APC was evaluated more favorably than TAG. No other significant differences were found in terms of course, level or gender.

A demographic profile of participants in ASTS courses was constructed. Former students were --during the time of the study-- about 18 to 19 years old, mostly attending a variety of colleges and universities, and majoring in a variety of areas, with a GPA over 3.00. Teaching partners were about 43 years old but with a large variance, had about 16 years of experience as teachers, also with a large variance, and not all of them were certified mathematics teachers, neither during their first year as teaching partner nor during the time of the study. APC participant schools were three times larger than TAG schools, had more mathematics and certified teachers than TAG schools, and had about 94 mathematics students for each mathematics teacher, while the ratio for TAG schools was 60 to 1.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary Of The Study

This study used a mail survey research approach. Three main types of variables were measured, for both AP Calculus (APC) and Trigonometry/Analytic Geometry (TAG) courses, at each of three levels (former students, teaching partners and school administrators): A set of variables used as indicators of effectiveness of ASTS mathematics courses; a set of scales asking the respondents to rate specific items of the course as well as an overall evaluation, in order to identify what items were statistically related to the overall evaluation; and a set of demographic variables, used to build a demographic profile of participants in ASTS mathematics courses.

Six different questionnaires were sent, one for each of the six groups. The questionnaires were reviewed by a group of college students involved in ASTS mathematics courses as assistants, by the OSU professors teaching both courses, and by ASTS personnel. Corrections and improvements were included in the final versions of the instruments.

The mail survey was sent to the whole population. Names and addresses of the subjects were obtained from records kept by the OSU professors teaching the ASTS mathematics courses. Since AP Calculus did not have records of students' addresses prior to the school year 1991-1992, only those students who took AP Calculus in 1991 were included in the survey. The rest of the groups included former participants since 1987.

Data were collected, coded and entered in a computer where three types of statistical analysis were conducted: Descriptive statistics, analysis of correlation, and analysis of variance. The statistics were used to evaluate the effectiveness of the courses, to test statistical hypotheses regarding relationships between/among the variables, and to build a demographic profile of former ASTS participants.

Four methodological issues limit the results of this study: The measurement of effectiveness was far from a complete one; the response rate was less than perfect, and since the respondents chose whether to participate in the study, they could not be assumed to be a representative sample of the population; the lists of members of the population were incomplete; and the study did not differentiate the responses provided by former participants in different years.

A total of 338 questionnaires were returned, out of a total of 892 questionnaires sent to the three groups under study, for an overall response rate of 37.89. This percentage was not with respect to a sample but to the whole population. To test its representativeness, the sample was compared to the population in terms of gender, high school from which former students graduated, and state in which those schools are, without finding significant differences.

Descriptive statistics were obtained for a set of variables related to the measurement of effectiveness in distance education. A model to measure the effectiveness of ASTS mathematics courses was proposed and applied to the results. It was concluded that, in general, ASTS mathematics courses met the criteria of effectiveness or were close to meting them. ASTS courses seemed especially helpful as preparation for high school students to attend college successfully. Although at the three levels --student, teaching partner and school administrator-- the evaluation of the ASTS experience was mostly within the "satisfactory" range, ASTS did not seem to be clearly perceived as a good professional development opportunity by teaching partners, nor a help to improving mathematics curriculum at the participating schools.

Correlation statistics were applied to specific items of the *Evaluation of the experience* variable and the *Overall* evaluation. In general, all the items were statistically related to the overall evaluation, but it was "Knowledge of the subject after taking the course" that consistently showed a strong relationship to the overall evaluation throughout the levels. Also related, but not as consistently, were "OSU professor performance" and "Relevance of course contents."

An analysis of variance (ANOVA) showed statistically significant differences ($p = 0.05$) in the overall evaluation of APC and TAG. This means that, overall, APC was evaluated more favorably than TAG. No other significant differences were found in terms of course, level or gender.

A demographic profile of participants in ASTS courses was constructed. Former students were --during the time of the study-- about 18 to 19 years old, mostly attending a variety of colleges and universities, and majoring in a variety of areas, with a GPA over 3.00. Teaching partners were about 43 years old but with a large variance, had about 16 years of experience as teachers, also with a large variance, and not all of them were certified mathematics teachers, neither during their first year as teaching partner nor during the time of the study. APC participant schools were three times larger than TAG schools, had more mathematics and certified teachers than TAG schools, and had about 94 mathematics students for each mathematics teacher, while the ratio for TAG schools was 60 to 1.

Conclusions

Several conclusions can be drawn from the study. First, the methodological approach --multi-level analysis, follow-up study-- provided an abundance of information regarding ASTS mathematics courses, with the possibility of doing cross-level analysis.

Second, the theoretical approach to distance education --to see distance education as an "alternative" to conventional education, instead of as a "perfect substitute" for it--

allowed a measurement of the effectiveness of ASTS according to a multi-level, multi-variable model, in opposition to a simple measurement based on a single variable at one particular level. Such a model had deficiencies, however, because it could not prove causal relationships and it had to be based on the interpretation of statistical data according to a proposed set of criteria.

According to the interpretation of data, ASTS mathematics courses were considered effective for high school students who were preparing for college. The programs were not as effective at the teaching partner and school level, since no strong evidence was found that the courses were good professional development opportunities for high school teachers and a help in improving the mathematics curriculum at the participating schools. Nevertheless, the experience of participating in ASTS mathematics courses was considered satisfactory at the three levels, with AP Calculus By Satellite obtaining a more favorable evaluation than Trigonometry/Analytic Geometry.

Another conclusion referred to the elements of the ASTS distance education model that were related to the overall evaluation of the experience. The perceived knowledge obtained after taking the course was the most strongly related element at the three levels. This conclusion was important since it suggested a results-oriented nature of those participating in ASTS mathematics courses. Additionally, gender did not seem to be related to the evaluation of the courses.

The demographic profile of participants showed, at the student level, high school students who ranked in the top 20 percent of their class, most of whom currently attend a variety of colleges and universities and maintain a GPA over 3.00. At the teaching partner level, the profile showed teachers whose average age is around 43, with approximately 16 years of experience as teachers, but with a relatively high dispersion of data; despite the fact that it is required by an ASTS policy, not all of them were certified mathematics teachers. At the school level, the profile showed both small and large schools, with

certified mathematics teachers teaching approximately 60 (for Trigonometry/Analytic Geometry) to 94 (for AP Calculus) students each.

The analysis of students' reasons for participating in ASTS mathematics courses raised the question of to what extent ASTS is an alternative to conventional education. Although students reported enrolling in the programs to prepare for college and to get an idea about how a college course would be, they did not clearly report enrolling because it was the only way they could take a course like that. Therefore, for some students ASTS courses fill a need that conventional education fails to fill, but for some others there seemed to be similar conventional courses available.

This increases the difficulty of measuring the effectiveness of ASTS mathematics courses since a mixed model of distance education arises in which some participants look for a substitute to conventional education, while others look for an alternative to close the gap created by the failure of conventional education to offer access to everybody.

Recommendations

Recommendations To ASTS

The survey included an open-ended question asking for suggestions to improve ASTS mathematics courses. The lists of suggestions provided by each group are included in the Appendices of the thesis. This section presents some recommendations directly related to the findings of this study.

According to the results, the teaching partner program should be improved. Specific actions would be: to enforce the policy of certification for those who act as teaching partners, to offer a formal training program for teaching partners, and to establish a close relationship with school administrators in order to identify specific ways in which ASTS courses could help to improve the mathematics curriculum at the school.

Students reported that encouragement by their school teacher was an important reason for participating in ASTS courses. Therefore, the teachers could play an important role in ASTS marketing strategies for the courses.

Since the perceived knowledge of the subject after taking the course--either AP Calculus or Trigonometry/Analytic Geometry-- was closely related to the overall evaluation of the course, emphasis on student learning would help to improve even more the satisfaction with the courses. For example, encouraging students to take the AP Calculus exam, or another standardized test for trigonometry, may give the student a tool to judge better how well he/she has learned with respect to a larger population.

A very important recommendation to ASTS would be to create a permanent effort to conduct evaluative and theoretical research. Systematic evaluation would provide immediate and continuous feedback about how well ASTS is doing with respect to its objectives and goals. Although ASTS has contributed enormously to distance education in the United States in terms of practical experiences, there is still a vacuum regarding theoretical contributions that eventually must be filled.

In order to conduct either evaluative or theoretical research, ASTS should improve its record keeping procedures. The creation of a computer database to include data regarding every participant in the courses is strongly recommended. Research projects might be more accurate and less complicated if information about current and past participants could be accessed and processed easily and reliably.

Recommendations For Further Research

Although this project was a multi-level, follow-up study, it was far from being a complete one. Emphasis was put at the student level, and the time variable covered a short period. Therefore, it is strongly recommended that new research be conducted analyzing more variables at the teaching partner and school levels and following-up

former participants for a longer period. Moreover, the conclusions of this study suggested new questions regarding the student level.

For example, a study could be conducted in order to measure changes --if any-- in students' aspirations toward college from the beginning to the end of the courses. Another study could compare the correlation of specific elements of the course with the overall satisfaction among different ASTS courses, such as those in languages, economics, government, sciences and reading. Since those courses seem to be aimed at a different type of student than the courses in mathematics, different types of correlation and a different demographic profile of participants may be found.

Regarding teaching partners, further research may focus on their qualifications to teach courses similar to those offered by ASTS. Another area of interest would be the relationship they create and sustain during the course with their students and with the OSU faculty and staff.

At the school level, an in-depth study of the school mathematics curriculum could be done in order to understand the role that ASTS is playing --or may play-- in its improvement. In addition, the analysis of funding options and limitations may help to understand why school enrollment has been so unpredictable through the years.

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APPENDICES

APPENDIX A

SUGGESTIONS FOR IMPROVING ASTS MATHEMATICS COURSES PROVIDED BY FORMER STUDENTS, TEACHING PARTNERS AND SCHOOL ADMINISTRATORS

SUGGESTIONS PROVIDED BY FORMER AP CALCULUS STUDENTS

Suggestion	Freq.
The call in students with their pictures were nice, but keep it short. (Wasted too much time on pictures of other classes). (More direct to Calculus, not to photographs or stories).	5
Move a little quicker on examples, unless people call in with problems, but sometimes dwelled on one problem too long. (Go a little faster).	4
A better teaching partner. (Make sure the teaching partner knows what they are doing).	4
I learned more from my teacher than the guy on TV.	3
I might want to go into the problems in more detail. (The professor should explain the simple steps briefly instead of skipping them).	3
Better time management on broadcast. Sometimes Dr. Choike had very little time to cover certain topics in a particular lesson. Spend more time on more difficult lectures rather than the beginning, easier lectures.	3
Overall, the course was planned and organized well. A very good course and service.	3
Solve more problems on air time. (More of the lecture guide problems could be worked out on the air).	3
I feel that the lady who filled in for Dr. Choike did a poor job in giving the lecture. Dr. Choike should pre-record the lesson instead of letting that lady do it.	3
You could find a different way to teach it because we didn't watch the satellite. The teaching partner taught us. (Our teaching partner taught us almost the entire second semester).	2
It went so fast. I only learned something during the first 9 weeks. (Teach the course at a slower rate).	2
The problems were not adequately explained. He only did the easy problems and not the harder ones.	2

Suggestion	Freq.
Dr. Choike is a great professor, with personality. (Dr. Choike is a very good teacher).	2
More worksheets on AP exam material could be given out to students earlier, as well as practice AP exams. (Help to prepare for the AP exam).	2
If homework problems were made mandatory (as part of the course grade) maybe students would learn even more. (More homework).	2
Get rid of Jim Choike. (Dr. Choike is my worst memory. He makes many mistakes and wastes too much time on photos).	2
More leeway for the teaching partner to explain difficult concepts. (More emphasis on teaching partner).	2
Talk about the delta-epsilon theory. It blew me away when I took Calculus in college.	2
I did not like the way Celest Campbell presented the lessons. She seemed to follow the notes, but she couldn't answer the students questions. She simply scribbled down a bunch of problems with little explanation. (Get rid of Celeste Campbell).	2
You need a good teaching assistant to make the class.	1
The teacher was boring and took it slow over the easy stuff.	1
It was an informational class for me. Very good OSU instructor.	1
Augment the workbook more as far as explanations and practice problems go. I found the workbook much more understandable than the lengthy, wordy textbook explanations.	1
If a substitute must teach, have him/her teach the same way the regular professor does.	1
Put more emphasis on homework and work done off the TV.	1
I would really discourage anyone from taking this course.	1
To get every single student to do his homework and to make them to study everyday.	1
Since the teaching partner was often of little help, using a text with better explanations would be of great help.	1
The one question quizzes need to go. If the student does not have a full understanding of the section, it is impossible for them to score well on the quiz.	1
The course itself was well presented, but my problems with AP Calculus were the result of a bad relationship with my teaching partner.	1

Suggestion	Freq.
A lot of time was wasted, and not enough problems were done.	1
The written examples need to be much more clearer and understandable.	1
The professor showed many definitions that weren't applicable.	1
I think more people would take the final exam if it did not cost as much.	1
Don't have graduate students filling in for Dr. Choike. The student that we had confused us more that she helped us. The days which she taught were a waste of time.	1
I thought it was an excellent class and encourage other people to take an AP class.	1
It might help to review material as you present new material. Such as review derivations a little while presenting antiderivations.	1
Invite Liberty High School to OSU sometime.	1
Much of the time used to answer questions from callers was a wasted time, because many of the questions could and should have been answered by the teaching partner.	1
Longer class periods.	1
There needs to be more adherence to the schedule.	1
Too much responsibility is being placed on the teaching partner when material is insufficiently covered by the satellite instructor.	1
Advise the professor to teach to 17-18 year oldies, not 12-13 year oldies.	1
Screen applicants more carefully. As it is there wasn't enough class time for those of us unfamiliar with Calculus.	1
The AP Calculus By Satellite program was not very helpful. The program should be dropped.	1
Make sure material is well covered before administering quizzes.	1
The professors should open up more with the students and forget their professional egos. If students do not get it the first time, the professors should be patient and kind.	1
The APCBS hotline should be open longer.	1
More time should be spent on learning area and volume problems during the second semester. It was rushed to learn the material.	1
Leave more difficult problems on the screen longer so you can get all the important information.	1
Some quiz problems were harder than lecture guide problems.	1

Suggestion	Freq.
Make the telecast appear more personal and not so "business like."	1
Make the broadcast a little more lively. Maybe change the set 2nd semester. At times it was very hard to pay attention and stay awake.	1
Keep phones and phone lines in good repair. Extra phone lines would be helpful also.	1
The course was a waste of money and time. It's too hard to try to learn a course as advanced as Calculus in 30 min. a wee and thousands of miles away.	1
Cut the class our altogether and hire each school its own personal Calculus teacher.	1
Save questions from previous telecasts to after current information has been presented or set a time limit for discussing them at the beginning.	1
The professor began the course teaching very slowly and concentrating on details, but as the material became more difficult, he ceased doing this. He should have begun at a faster pace and then slowed down with time.	1
Try to cover the main part instead of the whole book.	1
The broadcast spent too much time working viewer called-in problems and not enough time on the fundamentals necessary to do well in Calculus.	1

SUGGESTIONS PROVIDED BY FORMER

TRIGONOMETRY/ANALYTIC GEOMETRY STUDENTS

Suggestion	Freq.
The class was rushed along too much. Adequate time was not really provided to learn the material and apply it to situations of the "real world" type. (The class should be slowed down. It moved rather fast).	7
Make examples for each type of homework problem; it is hard to figure out how to work some of the problems. (More examples of each problem).	3
We had a problem with the broadcast and class time coinciding. (Course couldn't be seen "live"). (We didn't have access to question while the class was being taught).	3

Suggestion	Freq.
The teaching partner at our school did not know the materials. (Couldn't answer questions) (Partners who have taken the courses in college to help with the class).	3
I feel the program is great as it is. I feel Dr. Jobe was a very good teacher, and his program was well organized and useful. (Don't change a thing!).	3
Make more adequate ways of talking to the teacher when there is a question. (Provide better means of student-professor interaction).	2
I think the course was well taught. (Overall it was an OK course).	2
I think there should be more emphasis put on the Pre-calculus part of the course and less on the Analytical Geometry. (This half of the course helped me a lot in college Calculus. More time should be spent on limits and derivatives).	2
More clarity in teaching. (Explain material in more detail).	2
Dr. Jobe performed fabulously in presenting the material. Jean Byrd worked with me on any problems that arose. I thoroughly enjoyed taking the course. (No complain about Trig. Dr. Jobe and Jean were great!).	2
I would be better if you could get to know your professor first. It helps when they tell a little about themselves, but I would rather meet the person that is teaching (at least every month or so) so that they are more human for me, not another person on a screen.	2
It was really helpful.	1
I considered becoming a mathematics major because of it.	1
Make the professor who instructed the class more available.	1
I had a lot harder time comprehending the material when a teaching assistant instructed the class, as opposed to Dr. Jobe.	1
Not using Jenny Rarrey (all she did was take the things that our class could understand and even messed them up too).	1
Dr. Jobe should explain the problems that the students call in with.	1
When grading papers, there should be an explanation why the student got it wrong and how to do it correctly.	1
Get rid of this program. It was of no use in college preparation. No comparison can be made between this course and college courses. One cannot learn mathematics by watching television and having a "baby sitter." One needs a teacher and a figure who cares about the course and the students.	1

Suggestion	Freq.
Needs better instructors.	1
Needs to be a lot more interesting.	1
If it were not for my high school teacher, my former classmates, and I would all have flunked that course. I credit her and only her for helping me pull an A out of that class.	1
The first semester, my class would call in and ask Dr. Jobe a question, but he couldn't answer half of them. I believe that if you are going to be a professor for satellite, you should at least be able to answer the questions that are asked. This is why I dropped the course.	1
We had problems with the weather affecting our satellite dish.	1
The test were too far apart.	1
Homework should be counted into grades.	1
The instructor should try to stay more on the subject and take more time on each lesson because a lot of people doesn't want to call in to ask questions.	1
I realize that "x" amount of chapters must be covered, so I suggest that the OSU staff tell the students and the teaching partner to record the taping daily on a VCR and watch it at the pace of the students.	1
Dr. Jobe should have gone over more difficult problems to introduce us to a level of difficulty that the tests sometimes endured.	1
The professor seemed to skip around a little but it was okay because he always explained where he was.	1
Offering the course every day instead of twice a week would be helpful.	1
Get the teaching partner more involved with understanding the material ahead of the class period.	1
Many times it was hard to understand the professor and what he was trying to say.	1
It was very difficult to learn from the television without having a teacher immediately present to ask questions at the moment.	1
Please stress strongly that for a math class a phone hook-up is definitely necessary.	1
The professor teaching the course needs to remember he is teaching high school students; he needs to stop assuming that the students know so many things.	1
There could have been a little more student participation.	1

Suggestion	Freq.
I just feel that you learn more from the regular classroom setting.	1
Show every step in the process of solving the problem, don't skip steps.	1
The workbook and textbook do not correspond or show the same methods in solving the problem as the teaching partner.	1
The tests aren't worded in a way that helps you know exactly what is being asked.	1
The assistant to Dr. Jobe taught too fast for high school students.	1
The telecast was presented in a way that bettered my road for college.	1
I felt a little intimidated by having to call in to get a question answered so I never called in. I always asked my teacher at school.	1
It was very good class I learned a lot. I wouldn't change anything.	1
The person responsible for the telephone service should try to keep the phone lines working all the time. Students do better when they can talk immediately to the teacher.	1
Don't sign non-qualified teachers as instructors. It should be taught by someone with a degree in mathematics.	1
Dr. Jobe was lacking as a television personality.	1
Everything I learned in my class was from my teaching partner.	1
Some areas can't offer classes such as Trig/A.G. so it is great to have satellite ones available.	1
That the professor teach more than one way of working a problem so that the student can or may understand the problem more fully.	1
Have more quests for your "Career Corner" portion of the show. Your quest were very interesting and I think your present and future students would enjoy them also.	1

SUGGESTIONS PROVIDED BY FORMER AP

CALCULUS TEACHING PARTNERS

Suggestion	Freq.
More problem examples. (Better example problems on reviews).	2

Suggestion	Freq.
Answers to study sheets to exam should be included in the teachers guide. (Publish answers to review exercises). (Answers and solutions to review problems should be supplied. It was very time consuming for the teaching partner to work these out so students could check their work).	2
The instructor needs to finish lessons before students are tested over the material. Students are frustrated when they are tested over material that they have not be taught.	1
The greatest lapses in continuity occurred when someone subbed for Dr. Choike. Last year Celeste Campbell had the habit of flipping back and forth between two pages and it was very hard to follow.	1
I feel that being a teaching partner had a profound impact on my own knowledge and teaching skills of Calculus.	1
Different text.	1
Better explanations.	1
Students need to be held more responsible for lessons taught on TV so they don't solely rely on the teaching partner to "re-teach" them on days there is no TV lesson.	1
I had an excellent experience with the satellite program. It is one of the most valuable experiences I have had in my teaching career.	1
It is important to begin incorporating calculators into the curriculum. You may already be doing that.	1
Stress students' prerequisites.	1
Dr. Choike and his helpers were always there for my student. He enjoyed getting their help. The ladies on the telephone ever recognized my student by voice and he developed a good relationship with them.	1
More detailed solutions to problems should be worked out in the students' guide.	1
I am very satisfied with the structure of the class and Dr. Choike's approachability.	1
More lecture, less time spent on pictures.	1
The course is not designed for all high school Calculus students. Learning by TV works only for self-motivated students.	1
Our school made a mistake of placing all students in the satellite program in order to save a teaching hour.	1

Suggestion	Freq.
Additional phone lines for access to instructor during class. Many times we have tried to call and got busy signal.	1
Dr. Choike is a master teacher and a considerate individual. Please thank him for a fine course.	1
Less talk.	1
Must gear vocabulary towards high school level.	1
Could use more information about AP test.	1
More immediate feedback.	1
It has been an excellent program for me and my students. The professor delivers excellent presentations and the staff has been terrific. Other than a few errors in the lecture guide workbook, we have no complaints.	1
I am very impressed with the quality of your material. The reason I'm teaching AP Calculus this year is because my enrollment is down to the point when the ad won't allow me to teach an hour per day. AP is just part time for me.	1
Better proofreading of the workbook. Far too many incorrect answers are given in the teachers manual.	1
Show examples in each unit. Now it jumps from the theory to the problems.	1
Stop spending so much time with the pictures and chit- chat on phone calls. I would prefer that questions were called in but not put on the air at all. My kids hate the interruptions.	1
Air time should not be used for working our problems from past assignments that most students that kept up in the course had already worked.	1
There is a problem with communications that cannot be avoided.	1
It was a learning experience for me. Unfortunately the school has cut the funds due to a shortage.	1
Written materials: You might consider adding some color to the lessons to stress certain points or concepts.	1
Lengthening time allowed for test or lessening material on tests. 45 minutes is just not enough, even for a very good student.	1

SUGGESTIONS PROVIDED BY FORMER

TRIGONOMETRY/ ANALYTIC GEOMETRY

TEACHING PARTNERS

Suggestion	Freq.
Dr. Jobe and his assistant were excellent. I cannot think of any way to improve the class.	1
Require math certification to be a teaching partner. I was frustrated all year because I could not help the students.	1
Use software to provide on screen graphics.	1
Include video clips of "real life" applications of problems.	1
Kids seems to enjoy career corner; might try to do that more often.	1
Our students who took the class had very positive experiences.	1
My experience was not so good. I taught seven periods (different preps) and was expected to help satellite kids whenever we found time. A history teacher monitored the satellite room through a glass from her room.	1
Distance learning has been a real enhancement to our program. I am very disappointed that the Trigonometry and Geometry class will not be offered next year.	1
Dr. Jobe is an excellent instructor (I wish I had classes to him in college) but he is too fast for many high school students.	1

SUGGESTIONS PROVIDED BY FORMER AP

CALCULUS SCHOOL ADMINISTRATORS

Suggestion	Freq.
The cost is a major concern.	2
More time should be used on instruction and less on "socializing."	1
The course moved too quickly for our students. They don't have the background necessary to do well.	1
There wasn't teacher partner training!	1

Suggestion	Freq.
I have been pleased with almost every aspect of AP Calculus, but regarding the test, it appears that 45 minutes may not be quite adequate to complete work and check over responses. My only student who is a very good student has had difficulty staying within this time frame.	1
The program was excellent. Problems encountered were due to our coming into the program late.	1

SUGGESTIONS PROVIDED BY FORMER TRIGONOMETRY/ANALYTIC GEOMETRY SCHOOL ADMINISTRATORS

Suggestion	Freq.
The instructor could use the software available to teach faster.	1
Slow down.	1
Answer the phone!	1
Review more consistently what has been taught in each lesson at the end of broadcast.	1

APPENDIX B

QUESTIONNAIRES, FIRST COVER LETTERS AND FOLLOW-UP COVER LETTERS SENT TO FORMER STUDENTS, TEACHING PARTNERS AND SCHOOL ADMINISTRATORS (BOTH AP CALCULUS AND TRIGONOMETRY/ANALYTIC GEOMETRY)

December, 1991

Dear former ASTS student:

I am conducting a research project on Oklahoma State University's Arts and Sciences Teleconferencing Service (ASTS). This study attempts to follow up former ASTS mathematics students, in order to obtain their opinions about the courses and to get an idea of what they are doing now.

The results of the study will be the basis for my master's degree thesis. Additionally, a report will be presented to the ASTS administration and faculty, who have kindly supported my research effort.

I would appreciate it if you would take a few minutes of your time to answer the enclosed questionnaire, and return it to me in the postage-paid envelope by **January 15, 1992.**

Your frankness in answering the questions is crucial to obtaining information that can be used to improve the courses in the future. I understand your need to be assured of a confidential treatment of your responses, and so I guarantee you that your name will not be associated with your answers in any way.

Should you have any questions regarding the nature of this survey, please feel free to call Leigh Beaulieu, Director of ASTS, 1-800-452-2787 or (405) 744-7895; Dr. Jim Choike, your former professor via satellite, 1-800-445-7891; or Dr. Connie Lawry, my thesis advisor, (405) 744-5647. For questions related to the questionnaire, please call me at (405) 744-7895, or (405) 744-3560.

Your opinion about your ASTS mathematics course is extremely valuable to Dr. Choike and to Oklahoma State University. I thank you in advance for your cooperation.

Sincerely,

José R. López

Jose Rafael Lopez-Islas

ASTS graduate assistant and OSU graduate student.

AP Calculus By Satellite Former Student Questionnaire

DIRECTIONS:

Your completion of this questionnaire can be helpful for future students of **AP Calculus By Satellite**. Your frank, sincere responses, and those of other former students, will be used as a feedback to the course. Your answers will be processed with strict respect for your anonymity, and the results of the study will be published without mention of names or other information that could link your answers to you.

Please follow the specific directions for each section. Although the questionnaire is relatively long, it is not complicated. We estimate it will take you approximately ten minutes to complete it. Once you have completed all the questions, please return the questionnaire to us using the enclosed postage-paid envelope. If you have any questions regarding this survey, please call Jose Rafael Lopez at Oklahoma State University, Arts and Sciences Teleconferencing Service, 1-800-452-2787 or (405) 744-7895.

Thank you for your time and your candor.

1. Please list all the high school course(s) you took by satellite. Please give the year in which you began the course. For example, if you were enrolled in the class in the 1988-1989 school year, list the year as 1988.

   a. _____ Year: _____

   b. _____ Year: _____

   c. _____ Year: _____

   d. _____ Year: _____

2. Please list all the mathematics courses (satellite and non-satellite) you took in high school. Where possible, please give as complete a course title as you can remember.

   a. _____

   b. _____

   c. _____

   d. _____

   e. _____

AP Calculus By Satellite Former Student Questionnaire

3. Are you attending college currently?

❑ Yes, I am attending college currently.
(Please go to question # 4 on this page)

❑ No, I have already graduated from college.
(Please go to question # 4 on this page)

❑ I started college but dropped out
(Please go to question # 13 on page 3)

❑ No, I have never attended college.
(Please go to question # 23 on page 5)

4. College or university you are currently attending or from which you graduated:

Name: _____

Is it a ❑ Four-year college **or a** ❑ Two-year college?

5. Major:_____ 6. Minor:_____

7. Level at the present time:

❑ Freshman
❑ Sophomore
❑ Junior
❑ Senior
❑ Already graduated. Please indicate graduation date: (month/year) ____/____.

8. College GPA (grade point average) to date (or upon graduation): _____ on a scale of 4.0

9. Do you plan to enroll in graduate studies?

Definitely yes	Probably yes	Probably no	Definitely no	I don't know
❑	❑	❑	❑	❑

AP Calculus By Satellite Former Student Questionnaire

For questions 10 and 11, please mark the point on the scale that best represents your agreement or disagreement with the statement.

10. When I went to college, I was adequately prepared to take college-level mathematics courses.

Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
❑	❑	❑	❑	❑

11. When I took college-level math courses, I was at a disadvantage with respect to other students.

Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
❑	❑	❑	❑	❑

12. How satisfied are you with being a college student?

Very satisfied	Satisfied	Uncertain	Unsatisfied	Very unsatisfied
❑	❑	❑	❑	❑

Please skip to question # 26 on page 6.

13. College or university you attended. If you attended more than one, please name the most recent:

Name: _____

Is it a ❑ Four-year college **or a** ❑ Two-year college?

14. Major:_____ **15.** Minor:_____

16. Level when you left college:

❑ Freshman ❑ Sophomore ❑ Junior ❑ Senior

AP Calculus By Satellite Former Student Questionnaire

17. GPA (grade point average) at the time that you left college: _____ on a scale of 4.0

18. Do you plan to continue your studies later?

Definitely yes	Probably yes	Probably no	Definitely no	I don't know
❑	❑	❑	❑	❑

For questions 19 and 20, please indicate the point on the scale that best represents your agreement or disagreement with the statement.

19. When I went to college, I was adequately prepared to take college-level mathematics courses.

Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
❑	❑	❑	❑	❑

20. When I took college-level math courses, I was at a disadvantage with respect to other students.

Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
❑	❑	❑	❑	❑

21. Please mark the point on the scale that best represents the importance to you of each of the following possible reasons for leaving college:

	Most important					Least important
Lack of money	❑	❑	❑	❑	❑	❑
Family problems	❑	❑	❑	❑	❑	❑
Poor academic performance	❑	❑	❑	❑	❑	❑
Loss of motivation	❑	❑	❑	❑	❑	❑
Wrong choice of college	❑	❑	❑	❑	❑	❑

AP Calculus By Satellite Former Student Questionnaire

Other reasons for dropping out (please indicate as many as necessary):

_____

_____

_____

_____

22. How satisfied are you with your present situation?

Very satisfied	Satisfied	Uncertain	Unsatisfied	Very unsatisfied
❑	❑	❑	❑	❑

Please skip to question # 26 on page 6.

23. Do you plan to attend college later?

Definitely yes	Probably yes	Probably no	Definitely no	I don't know
❑	❑	❑	❑	❑

24. Please mark the point on the scale that best represents the importance to you of each of the following possible reasons for not attending college:

	Most important					Least important
Lack of money	❑	❑	❑	❑	❑	❑
My application was rejected	❑	❑	❑	❑	❑	❑
Lack of motivation	❑	❑	❑	❑	❑	❑
Low high school GPA	❑	❑	❑	❑	❑	❑
Lack of counseling in high school	❑	❑	❑	❑	❑	❑
Opposition of my family	❑	❑	❑	❑	❑	❑
Never expected to attend college	❑	❑	❑	❑	❑	❑

AP Calculus By Satellite Former Student Questionnaire

Other reasons for not attending college (please indicate as many as necessary):

_____

_____

_____

_____

25. How satisfied are you with your present situation?

Very satisfied	Satisfied	Uncertain	Unsatisfied	Very unsatisfied
❑	❑	❑	❑	❑

26. Please mark the point on the scale that best reflects the importance to you of each of the following possible reasons for taking **AP Calculus By Satellite:**

	Most important					Least important
It was the only way I could take a calculus course	❑	❑	❑	❑	❑	❑
I planned to take an AP exam	❑	❑	❑	❑	❑	❑
I wanted to prepare for college	❑	❑	❑	❑	❑	❑
I wanted to get an idea about how a college course would be	❑	❑	❑	❑	❑	❑
My teacher encouraged me to take the course	❑	❑	❑	❑	❑	❑
It was a personal challenge	❑	❑	❑	❑	❑	❑
I was forced to take the course	❑	❑	❑	❑	❑	❑
I wanted to experience a television course	❑	❑	❑	❑	❑	❑

AP Calculus By Satellite Former Student Questionnaire

Other reasons to take **AP Calculus By Satellite** (please indicate as many as necessary):

_____

_____

_____

_____

27. Please mark the point on the scale that best represents your answer to the question:

How do you rate **AP Calculus By Satellite** in terms of...?

	Very good				Very poor
Quality of written materials (course guides)	❑	❑	❑	❑	❑
Teaching partner performance	❑	❑	❑	❑	❑
Relevance of the course content	❑	❑	❑	❑	❑
OSU professor performance	❑	❑	❑	❑	❑
Access to OSU professor and staff for advice	❑	❑	❑	❑	❑
Quality of television broadcasts	❑	❑	❑	❑	❑
My knowledge of Calculus after taking the course	❑	❑	❑	❑	❑

28. Please mark the point on the scale that best represents your opinion about this:

In general, I consider that my experience with **AP Calculus By Satellite** was:

Very Satisfactory	Satisfactory	Uncertain	Unsatisfactory	Very Unsatisfactory
❑	❑	❑	❑	❑

AP Calculus By Satellite Former Student Questionnaire

29. Please mark the number on the scale that best represents your opinion on each of the following statements:

Compared to other mathematics courses I took in high school, **AP Calculus By Satellite** was:

Much better taught ❑	Better taught ❑	No difference ❑	Worse taught ❑	Much worse taught ❑
Much more difficult ❑	More difficult ❑	No difference ❑	Less difficult ❑	Much less difficult ❑
Much more useful ❑	More useful ❑	No difference ❑	Less useful ❑	Much less useful ❑

30. The high school grade you obtained in **AP Calculus By Satellite** was:

❑ A+ ❑ A ❑ A- ❑ B+ ❑ B ❑ B- ❑ C+ ❑ C ❑ C- ❑ D ❑ F

31. Did you take an AP (Advanced Placement) exam in calculus?

❑ No

❑ Yes. Please write your result _____. (Possible score on AP exam:1, 2, 3, 4, or 5).

32. Please write any suggestions you may have to improve **AP Calculus By Satellite**:

_____

_____

_____

_____

_____

_____

_____

AP Calculus By Satellite Former Student Questionnaire

Please tell us about you . . .

33. Age: _____ 34. Gender: ❑ Female ❑ Male

35. Name of your high school: _____

City _____ State_____

36. Your overall high school GPA (grade point average): _____ on a scale of 4.0.

37. Size of your high school graduating class:_____ students.

38. Your ranking with respect to your high school class:

❑ Top 20 percent ❑ Second 20 percent ❑ Middle 20 percent

❑ Fourth 20 percent ❑ Lowest 20 percent

39. Do you have a job now?

❑ No

❑ Yes. Please indicate type of job: ❑ Part time ❑ Full time ❑ Own business

Thank you for your cooperation!

December, 1991

Dear former ASTS student:

I am conducting a research project on Oklahoma State University's Arts and Sciences Teleconferencing Service (ASTS). This study attempts to follow up former ASTS mathematics students, in order to obtain their opinions about the courses and to get an idea of what they are doing now.

The results of the study will be the basis for my master's degree thesis. Additionally, a report will be presented to the ASTS administration and faculty, who have kindly supported my research effort.

I would appreciate it if you would take a few minutes of your time to answer the enclosed questionnaire, and return it to me in the postage-paid envelope by **January 15, 1992.**

Your frankness in answering the questions is crucial to obtaining information that can be used to improve the courses in the future. I understand your need to be assured of a confidential treatment of your responses, and so I guarantee you that your name will not be associated with your answers in any way.

Should you have any questions regarding the nature of this survey, please feel free to call Leigh Beaulieu, Director of ASTS, 1-800-452-2787 or (405) 744-7895; Dr. John Jobe, your former professor via satellite, 1-800-346-4210; or Dr. Connie Lawry, my thesis advisor, (405) 744-5647. For questions related to the questionnaire, please call me at (405) 744-7895, or (405) 744-3560.

Your opinion about your ASTS mathematics course is extremely valuable to Dr. Jobe and to Oklahoma State University. I thank you in advance for your cooperation.

Sincerely,

José R. López

Jose Rafael Lopez-Islas

ASTS graduate assistant and OSU graduate student.

Trigonometry/Analytic Geometry By Satellite Former Student Questionnaire

DIRECTIONS:

Your completion of this questionnaire can be helpful for future students of **Trigonometry/Analytic Geometry By Satellite**. Your frank, sincere responses, and those of other former students, will be used as a feedback to the course. Your answers will be processed with strict respect for your anonymity, and the results of the study will be published without mention of names or other information that could link your answers to you.

Please follow the specific directions for each section. Although the questionnaire is relatively long, it is not complicated. We estimate it will take you approximately ten minutes to complete it. Once you have completed all the questions, please return the questionnaire to us using the enclosed postage-paid envelope. If you have any questions regarding this survey, please call Jose Rafael Lopez at Oklahoma State University, Arts and Sciences Teleconferencing Service, 1-800-452-2787 or (405) 744-7895.

Thank you for your time and your candor.

1. Please list all the high school course(s) you took by satellite. Please give the year in which you began the course. For example, if you were enrolled in the class in the 1988-1989 school year, list the year as 1988.

   a. _____ Year: _____

   b. _____ Year: _____

   c. _____ Year: _____

   d. _____ Year: _____

2. Please list all the mathematics courses (satellite and non-satellite) you took in high school. Where possible, please give as complete a course title as you can remember.

   a. _____

   b. _____

   c. _____

   d. _____

   e. _____

Trigonometry/Analytic Geometry By Satellite Former Student Questionnaire

3. Are you attending college currently?

- ❑ Yes, I am attending college currently.
  (Please go to question # 4 on this page)
- ❑ No, I have already graduated from college.
  (Please go to question # 4 on this page)
- ❑ I started college but dropped out
  (Please go to question # 13 on page 3)
- ❑ No, I have never attended college.
  (Please go to question # 23 on page 5)

4. College or university you are currently attending or from which you graduated:

Name: _____

Is it a ❑ Four-year college **or a** ❑ Two-year college?

5. Major:_____ 6. Minor:_____

7. Level at the present time:

- ❑ Freshman
- ❑ Sophomore
- ❑ Junior
- ❑ Senior
- ❑ Already graduated. Please indicate graduation date: (month/year) ____/____.

8. College GPA (grade point average) to date (or upon graduation): _____ on a scale of 4.0

9. Do you plan to enroll in graduate studies?

Definitely yes	Probably yes	Probably no	Definitely no	I don't know
❑	❑	❑	❑	❑

Trigonometry/Analytic Geometry By Satellite Former Student Questionnaire

For questions 10 and 11, please mark the point on the scale that best represents your agreement or disagreement with the statement.

10. When I went to college, I was adequately prepared to take college-level mathematics courses.

Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
❑	❑	❑	❑	❑

11. When I took college-level math courses, I was at a disadvantage with respect to other students.

Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
❑	❑	❑	❑	❑

12. How satisfied are you with being a college student?

Very satisfied	Satisfied	Uncertain	Unsatisfied	Very unsatisfied
❑	❑	❑	❑	❑

Please skip to question # 26 on page 6.

13. College or university you attended. If you attended more than one, please name the most recent:

Name: _____

Is it a ❑ Four-year college **or a** ❑ Two-year college?

14. Major:_____ **15.** Minor:_____

16. Level when you left college:

❑ Freshman ❑ Sophomore ❑ Junior ❑ Senior

Trigonometry/Analytic Geometry By Satellite Former Student Questionnaire

17. GPA (grade point average) at the time that you left college: _____ on a scale of 4.0

18. Do you plan to continue your studies later?

Definitely yes	Probably yes	Probably no	Definitely no	I don't know
❑	❑	❑	❑	❑

For questions 19 and 20, please indicate the point on the scale that best represents your agreement or disagreement with the statement.

19. When I went to college, I was adequately prepared to take college-level mathematics courses.

Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
❑	❑	❑	❑	❑

20. When I took college-level math courses, I was at a disadvantage with respect to other students.

Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
❑	❑	❑	❑	❑

21. Please mark the point on the scale that best represents the importance to you of each of the following possible reasons for leaving college:

	Most important					Least important
Lack of money	❑	❑	❑	❑	❑	❑
Family problems	❑	❑	❑	❑	❑	❑
Poor academic performance	❑	❑	❑	❑	❑	❑
Loss of motivation	❑	❑	❑	❑	❑	❑
Wrong choice of college	❑	❑	❑	❑	❑	❑

Other reasons for dropping out (please indicate as many as necessary):

_____

_____

_____

_____

22. How satisfied are you with your present situation?

Very satisfied	Satisfied	Uncertain	Unsatisfied	Very unsatisfied
❑	❑	❑	❑	❑

Please skip to question # 26 on page 6.

23. Do you plan to attend college later?

Definitely yes	Probably yes	Probably no	Definitely no	I don't know
❑	❑	❑	❑	❑

24. Please mark the point on the scale that best represents the importance to you of each of the following possible reasons for not attending college:

	Most important					Least important
Lack of money	❑	❑	❑	❑	❑	❑
My application was rejected	❑	❑	❑	❑	❑	❑
Lack of motivation	❑	❑	❑	❑	❑	❑
Low high school GPA	❑	❑	❑	❑	❑	❑
Lack of counseling in high school	❑	❑	❑	❑	❑	❑
Opposition of my family	❑	❑	❑	❑	❑	❑
Never expected to attend college	❑	❑	❑	❑	❑	❑

Other reasons for not attending college (please indicate as many as necessary):

_____

_____

_____

_____

25. How satisfied are you with your present situation?

Very satisfied	Satisfied	Uncertain	Unsatisfied	Very unsatisfied
❑	❑	❑	❑	❑

26. Please mark the point on the scale that best reflects the importance to you of each of the following possible reasons for taking **Trigonometry/Analytic Geometry By Satellite:**

	Most important					Least important
It was the only way I could take a Pre-Calculus course	❑	❑	❑	❑	❑	❑
I wanted to prepare for college	❑	❑	❑	❑	❑	❑
I wanted to get an idea about how a college course would be	❑	❑	❑	❑	❑	❑
My teacher encouraged me to take the course	❑	❑	❑	❑	❑	❑
It was a personal challenge	❑	❑	❑	❑	❑	❑
I was forced to take the course	❑	❑	❑	❑	❑	❑
I wanted to experience a television course	❑	❑	❑	❑	❑	❑

Trigonometry/Analytic Geometry By Satellite Former Student Questionnaire

Other reasons to take **Trigonometry/Analytic Geometry By Satellite** (please indicate as many as necessary):

_____

_____

_____

_____

27. Please mark the point on the scale that best represents your answer to the question:

How do you rate **Trigonometry/Analytic Geometry By Satellite** in terms of...?

	Very good				Very poor
Quality of written materials (course guides)	❑	❑	❑	❑	❑
Teaching partner performance	❑	❑	❑	❑	❑
Relevance of the course content	❑	❑	❑	❑	❑
OSU professor performance	❑	❑	❑	❑	❑
Access to OSU professor and staff for advice	❑	❑	❑	❑	❑
Quality of television broadcasts	❑	❑	❑	❑	❑
My knowledge of Pre-Calculus after taking the course	❑	❑	❑	❑	❑

28. Please mark the point on the scale that best represents your opinion about this:

In general, I consider that my experience with **Trigonometry/Analytic Geometry By Satellite** was:

Very Satisfactory	Satisfactory	Uncertain	Unsatisfactory	Very Unsatisfactory
❑	❑	❑	❑	❑

Trigonometry/Analytic Geometry By Satellite Former Student Questionnaire

29. Please mark the number on the scale that best represents your opinion on each of the following statements:

Compared to other mathematics courses I took in high school, **Trigonometry/ Analytic Geometry By Satellite** was:

Much better taught ❑	Better taught ❑	No difference ❑	Worse taught ❑	Much worse taught ❑
Much more difficult ❑	More difficult ❑	No difference ❑	Less difficult ❑	Much less difficult ❑
Much more useful ❑	More useful ❑	No difference ❑	Less useful ❑	Much less useful ❑

30. The high school grade you obtained in **Trigonometry/Analytic Geometry By Satellite** was:

❑ A+ ❑ A ❑ A- ❑ B+ ❑ B ❑ B- ❑ C+ ❑ C ❑ C- ❑ D ❑ F

31. Please write any suggestions you may have to improve **Trigonometry/Analytic Geometry By Satellite:**

_____

_____

_____

_____

_____

_____

_____

Trigonometry/Analytic Geometry By Satellite Former Student Questionnaire

Please tell us about you . . .

32. Age: _____ 33. Gender: ❑ Female ❑ Male

34. Name of your high school: _____

City _____ State_____

35. Your overall high school GPA (grade point average): _____ on a scale of 4.0.

36. Size of your high school graduating class:_____ students.

37. Your ranking with respect to your high school class:

❑ Top 20 percent ❑ Second 20 percent ❑ Middle 20 percent

❑ Fourth 20 percent ❑ Lowest 20 percent

38. Do you have a job now?

❑ No

❑ Yes. Please indicate type of job: ❑ Part time ❑ Full time ❑ Own business

Thank you for your cooperation!

January, 1992

Dear teaching partner:

I am conducting a research project on Oklahoma State University's Arts and Sciences Teleconferencing Service (ASTS). This study attempts to follow up with teaching partners of ASTS mathematics courses, in order to obtain their opinions about the courses and to get an idea of what they are doing now.

The results of the study will be the basis for my master's degree thesis. Additionally, a report will be presented to the ASTS administration and faculty, who have kindly supported my research effort.

I would appreciate it if you would take a few minutes of your time to answer the enclosed questionnaire, and return it to me in the postage-paid envelope by **February 17, 1992.**

Your frankness in answering the questions is crucial to obtaining information that can be used to improve the courses in the future. I understand your need to be assured of a confidential treatment of your responses, and so I guarantee you that name will not be associated with your answers in any way.

Should you have any questions regarding the nature of this survey, please feel free to call Leigh Beaulieu, Director of ASTS, 1-800-452-2787 or (405) 744-7895; Dr. Jim Choike, AP Calculus By Satellite professor, 1-800-445-7891; or Dr. Connie Lawry, my thesis advisor, (405) 744-5647. For questions related to the questionnaire, please call me at (405) 744-7895, or (405) 744-3560.

Your opinion about the ASTS mathematics course for which you served as teaching partner is extremely valuable to Dr. Choike and to Oklahoma State University, and if you share it with me, ASTS will use it to improve the course and the overall program. I thank you in advance for your cooperation.

Sincerely,

José R. López

Jose Rafael Lopez-Islas

ASTS graduate assistant and OSU graduate student.

AP Calculus By Satellite Teaching Partner Questionnaire

DIRECTIONS:

Your completion of this questionnaire can be helpful for future students of **AP Calculus By Satellite**. Your frank responses, and those of other teaching partners, will be used to make improvements to the course. Your answers will be processed with strict respect for your anonymity, and the results of the study will be published without mention of names or other information that could trace your answers to you.

Please follow the specific directions for each section. Although the questionnaire is relatively long, it is not complicated. We estimate it will take you approximately ten minutes to complete it. Once you have completed all the questions, please return the questionnaire to us using the enclosed postage-paid envelope. If you have any questions regarding this survey, please call Jose Rafael Lopez at Oklahoma State University, Arts and Sciences Teleconferencing Service, 1-800-452-2787 or (405) 744-7895.

Thank you for your time and your candor.

1. Please mark the school years in which you were an **AP Calculus By Satellite** teaching partner.

   ❑ 1987-1988 ❑ 1988-1989 ❑ 1989-1990 ❑ 1990-1991 ❑ 1991-1992

2. Please list any other ASTS course(s) for which you have served as a teaching partner, and specify the school year(s) in which you served in this capacity.

   a. _____ Year(s): _____

   b. _____ Year(s): _____

   c. _____ Year(s): _____

   d. _____ Year(s): _____

   e. _____ Year(s): _____

   f. _____ Year(s): _____

   g. _____ Year(s): _____

AP Calculus By Satellite Teaching Partner Questionnaire

3. Are you currently an **AP Calculus By Satellite** teaching partner?

❑ Yes, I am currently an **AP Calculus By Satellite** teaching partner.

(Please go to question # 4 on this page)

❑ No, I am not currently an **AP Calculus By Satellite** teaching partner.

(Please skip to question # 7 on next page)

4. Please mark the point on the scale that best represents the importance of each of the following as a reason why you are currently an **AP Calculus By Satellite** teaching partner:

	Most important				Least important	Not applicable
Previous experiences as teaching partner were satisfactory	❑	❑	❑	❑	❑	❑
I was forced by the administration to be a teaching partner	❑	❑	❑	❑	❑	❑
Being a teaching partner is part of my professional development plan	❑	❑	❑	❑	❑	❑
I would like to teach an advanced placement course like this one in the future	❑	❑	❑	❑	❑	❑

Other reasons for being an **AP Calculus By Satellite** teaching partner (please indicate as many as applicable):

_____

_____

_____

_____

AP Calculus By Satellite Teaching Partner Questionnaire

5. For how many more years do you plan to be an **AP Calculus By Satellite** teaching partner?:

❑ None

❑ One more year

❑ Two more years

❑ Three or more years

❑ I do not know

6. How satisfied are you with being an **AP Calculus By Satellite** teaching partner?

Very satisfied	Satisfied	Uncertain	Unsatisfied	Very unsatisfied
❑	❑	❑	❑	❑

Please skip to question # 9 on page 4.

7. Please mark the answer that best describes your current job:

❑ I am currently a mathematics high school teacher.

(Please go to question # 8 on next page)

❑ I am a high school teacher but I do not currently teach mathematics.

(Please go to question # 8 on next page)

❑ I am not currently a high school teacher.

(Please skip to question # 9 on next page)

AP Calculus By Satellite Teaching Partner Questionnaire

8. Please mark the point on the scale that best represents the importance of each of the following as a reason why you are not currently an **AP Calculus By Satellite** teaching partner:

	Most important				Least important	Not Applicable
Previous experiences as teaching partner were unsatisfactory	❑	❑	❑	❑	❑	❑
I have new duties in the school that do not allow me to be a teaching partner	❑	❑	❑	❑	❑	❑
The school does not participate in **AP Calculus By Satellite**	❑	❑	❑	❑	❑	❑
I have now enough experience to teach a course like this one on my own	❑	❑	❑	❑	❑	❑

Other reasons for not being an **AP Calculus By Satellite** teaching partner (please indicate as many as applicable):

_____

_____

_____

_____

9. Are you currently a certified mathematics teacher?

❑ No ❑ Yes. Please specify:

❑ Temporary certification. Certification renewal date (mo/yr):____/____

❑ Permanent certification. Certification obtainment date (mo/yr): ____/____

AP Calculus By Satellite Teaching Partner Questionnaire

10. Were you a certified mathematics teacher the first year you served as an **AP Calculus By Satellite** teaching partner?

❑ No ❑ Yes.

11. Please mark the point on the scale that best represents your answer to the question:

How do you rate **AP Calculus By Satellite** in terms of...?

	Very good		Fair		Very poor
Quality of written materials (course guides)	❑	❑	❑	❑	❑
Teaching partner training	❑	❑	❑	❑	❑
Relevance of the course content	❑	❑	❑	❑	❑
OSU professor performance	❑	❑	❑	❑	❑
Access to OSU professor or staff for advice	❑	❑	❑	❑	❑
Quality of television broadcasts	❑	❑	❑	❑	❑
Student knowledge of calculus after taking the course	❑	❑	❑	❑	❑

For questions 12 and 13, please mark the point on the scale that best represents your agreement or disagreement with the statement.

12. A student can learn as much calculus in **AP Calculus By Satellite** as in a conventional calculus course (a certified teacher working directly with the students).

Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
❑	❑	❑	❑	❑

AP Calculus By Satellite Teaching Partner Questionnaire

13. **AP Calculus By Satellite** has been a good professional development opportunity for me.

Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
❑	❑	❑	❑	❑

14. Please mark the point on the scale that best represents your response to the following statement:

In general, I consider that my experience with **AP Calculus By Satellite** was:

Very Satisfactory	Satisfactory	Uncertain	Unsatisfactory	Very Unsatisfactory
❑	❑	❑	❑	❑

15. Please list below any suggestions you may have to improve **AP Calculus By Satellite:**

_____

_____

_____

_____

_____

_____

Please tell us about you . . .

16. Age: _____

17. Gender: ❑ Female ❑ Male

AP Calculus By Satellite Teaching Partner Questionnaire

18. Total number of years employed as a teacher: _____

19. Please list the mathematics courses you have taught during the last four years. Please mark those which you are teaching currently, if any.

Course name	Currently taught?
a. _____	Yes ❑ No ❑
b. _____	Yes ❑ No ❑
c. _____	Yes ❑ No ❑
d. _____	Yes ❑ No ❑
e. _____	Yes ❑ No ❑
f. _____	Yes ❑ No ❑
g. _____	Yes ❑ No ❑
h. _____	Yes ❑ No ❑

20. Please list the mathematics courses you took in college, using the most accurate and specific name of the course that you can recollect.

a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

g. _____

h. _____

Thank you for your cooperation!

January, 1992

Dear teaching partner:

I am conducting a research project on Oklahoma State University's Arts and Sciences Teleconferencing Service (ASTS). This study attempts to follow up with teaching partners of ASTS mathematics courses, in order to obtain their opinions about the courses and to get an idea of what they are doing now.

The results of the study will be the basis for my master's degree thesis. Additionally, a report will be presented to the ASTS administration and faculty, who have kindly supported my research effort.

I would appreciate it if you would take a few minutes of your time to answer the enclosed questionnaire, and return it to me in the postage-paid envelope by **February 17, 1992.**

Your frankness in answering the questions is crucial to obtaining information that can be used to improve the courses in the future. I understand your need to be assured of a confidential treatment of your responses, and so I guarantee you that name will not be associated with your answers in any way.

Should you have any questions regarding the nature of this survey, please feel free to call Leigh Beaulieu, Director of ASTS, 1-800-452-2787 or (405) 744-7895; Dr. John Jobe, Trigonometry By Satellite professor, 1-800-346-4210; or Dr. Connie Lawry, my thesis advisor, (405) 744-5647. For questions related to the questionnaire, please call me at (405) 744-7895, or (405) 744-3560.

Your opinion about the ASTS mathematics course for which you served as teaching partner is extremely valuable to Dr. Jobe and to Oklahoma State University, and if you share it with me, ASTS will use it to improve the course and the overall program. I thank you in advance for your cooperation.

Sincerely,

José R. López

Jose Rafael Lopez-Islas

ASTS graduate assistant and OSU graduate student.

Trigonometry/Analytic Geometry By Satellite Teaching Partner Questionnaire

DIRECTIONS:

Your completion of this questionnaire can be helpful for future students of **Trigonometry/ Analytic Geometry By Satellite**. Your frank responses, and those of other teaching partners, will be used to make improvements to the course. Your answers will be processed with strict respect for your anonymity, and the results of the study will be published without mention of names or other information that could trace your answers to you.

Please follow the specific directions for each section. Although the questionnaire is relatively long, it is not complicated. We estimate it will take you approximately ten minutes to complete it. Once you have completed all the questions, please return the questionnaire to us using the enclosed postage-paid envelope. If you have any questions regarding this survey, please call Jose Rafael Lopez at Oklahoma State University, Arts and Sciences Teleconferencing Service, 1-800-452-2787 or (405) 744-7895.

Thank you for your time and your candor.

1. Please mark the school years in which you were an **Trigonometry/Analytic Geometry By Satellite** teaching partner.

❑ 1987-1988 ❑ 1988-1989 ❑ 1989-1990 ❑ 1990-1991 ❑ 1991-1992

2. Please list any other ASTS course(s) for which you have served as a teaching partner, and specify the school year(s) in which you served in this capacity.

a. _____ Year(s): _____

b. _____ Year(s): _____

c. _____ Year(s): _____

d. _____ Year(s): _____

e. _____ Year(s): _____

f. _____ Year(s): _____

g. _____ Year(s): _____

Trigonometry/Analytic Geometry By Satellite Teaching Partner Questionnaire

3. Are you currently an **Trigonometry/Analytic Geometry By Satellite** teaching partner?

❑ Yes, I am currently an **Trigonometry/Analytic Geometry By Satellite** teaching partner. **(Please go to question # 4 on this page)**

❑ No, I am not currently an **Trigonometry/Analytic Geometry By Satellite** teaching partner.**(Please skip to question # 7 on next page)**

4. Please mark the point on the scale that best represents the importance of each of the following as a reason why you are currently an **Trigonometry/Analytic Geometry By Satellite** teaching partner:

	Most important				Least important	Not applicable
Previous experiences as teaching partner were satisfactory	❑	❑	❑	❑	❑	❑
I was forced by the administration to be a teaching partner	❑	❑	❑	❑	❑	❑
Being a teaching partner is part of my professional development plan	❑	❑	❑	❑	❑	❑
I would like to teach an advanced placement course like this one in the future	❑	❑	❑	❑	❑	❑

Other reasons for being an **Trigonometry/Analytic Geometry By Satellite** teaching partner (please indicate as many as applicable):

_____

_____

_____

_____

Trigonometry/Analytic Geometry By Satellite Teaching Partner Questionnaire

5. For how many more years do you plan to be an **Trigonometry/Analytic Geometry By Satellite** teaching partner?:

❑ None

❑ One more year

❑ Two more years

❑ Three or more years

❑ I do not know

6. How satisfied are you with being an **Trigonometry/Analytic Geometry By Satellite** teaching partner?

Very satisfied	Satisfied	Uncertain	Unsatisfied	Very unsatisfied
❑	❑	❑	❑	❑

Please skip to question # 9 on page 4.

7. Please mark the answer that best describes your current job:

❑ I am currently a mathematics high school teacher.

(Please go to question # 8 on next page)

❑ I am a high school teacher but I do not currently teach mathematics.

(Please go to question # 8 on next page)

❑ I am not currently a high school teacher.

(Please skip to question # 9 on next page)

Trigonometry/Analytic Geometry By Satellite Teaching Partner Questionnaire

8. Please mark the point on the scale that best represents the importance of each of the following as a reason why you are not currently an **Trigonometry/Analytic Geometry By Satellite** teaching partner:

	Most important				Least important	Not Applicable
Previous experiences as teaching partner were unsatisfactory	❑	❑	❑	❑	❑	❑
I have new duties in the school that do not allow me to be a teaching partner	❑	❑	❑	❑	❑	❑
The school does not participate in **Trigonometry/Analytic Geometry By Satellite**	❑	❑	❑	❑	❑	❑
I have now enough experience to teach a course like this one on my own	❑	❑	❑	❑	❑	❑

Other reasons for not being an **Trigonometry/Analytic Geometry By Satellite** teaching partner (please indicate as many as applicable):

_____

_____

_____

_____

9. Are you currently a certified mathematics teacher?

❑ No ❑ Yes. Please specify:

❑ Temporary certification. Certification renewal date (mo/yr):____/____

❑ Permanent certification. Certification obtainment date (mo/yr): ____/____

Trigonometry/Analytic Geometry By Satellite Teaching Partner Questionnaire

10. Were you a certified mathematics teacher the first year you served as an **Trigonometry/Analytic Geometry By Satellite** teaching partner?

❑ No ❑ Yes.

11. Please mark the point on the scale that best represents your answer to the question:

How do you rate **Trigonometry/Analytic Geometry By Satellite** in terms of...?

	Very good		Fair		Very poor
Quality of written materials (course guides)	❑	❑	❑	❑	❑
Teaching partner training	❑	❑	❑	❑	❑
Relevance of the course content	❑	❑	❑	❑	❑
OSU professor performance	❑	❑	❑	❑	❑
Access to OSU professor or staff for advice	❑	❑	❑	❑	❑
Quality of television broadcasts	❑	❑	❑	❑	❑
Student knowledge of trigonometry/analytic geometry after taking the course	❑	❑	❑	❑	❑

For questions 12 and 13, please mark the point on the scale that best represents your agreement or disagreement with the statement.

12. A student can learn as much trigonometry/analytic geometry in **Trigonometry/Analytic Geometry By Satellite** as in a conventional trigonometry/analytic geometry course (a certified teacher working directly with the students).

Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
❑	❑	❑	❑	❑

Trigonometry/Analytic Geometry By Satellite Teaching Partner Questionnaire

13. **Trigonometry/Analytic Geometry By Satellite** has been a good professional development opportunity for me.

Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
❑	❑	❑	❑	❑

14. Please mark the point on the scale that best represents your response to the following statement:

In general, I consider that my experience with **Trigonometry/Analytic Geometry By Satellite** was:

Very Satisfactory	Satisfactory	Uncertain	Unsatisfactory	Very Unsatisfactory
❑	❑	❑	❑	❑

15. Please list below any suggestions you may have to improve **Trigonometry/Analytic Geometry By Satellite:**

_____

_____

_____

_____

_____

_____

Please tell us about you . . .

16. Age: _____

17. Gender: ❑ Female ❑ Male

Trigonometry/Analytic Geometry By Satellite Teaching Partner Questionnaire

18. Total number of years employed as a teacher: _____

19. Please list the mathematics courses you have taught during the last four years. Please mark those which you are teaching currently, if any.

Course name	Currently taught?
a. _____	Yes ❑ No ❑
b. _____	Yes ❑ No ❑
c. _____	Yes ❑ No ❑
d. _____	Yes ❑ No ❑
e. _____	Yes ❑ No ❑
f. _____	Yes ❑ No ❑
g. _____	Yes ❑ No ❑
h. _____	Yes ❑ No ❑

20. Please list the mathematics courses you took in college, using the most accurate and specific name of the course that you can recollect.

a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

g. _____

h. _____

Thank you for your cooperation!

January, 1992

Dear school administrator:

I am conducting a research project on Oklahoma State University's Arts and Sciences Teleconferencing Service (ASTS). This study attempts to follow up with schools that have participated in ASTS mathematics courses.

The results of the study will be the basis for my master's degree thesis. Additionally, a report will be presented to the ASTS administration and faculty, who have kindly supported my research effort.

I would appreciate it if you would take a few minutes of your time to answer the enclosed questionnaire, and return it to me in the postage-paid envelope by **February 17, 1992.**

Your frankness in answering the questions is crucial to obtaining information that can be used to improve the courses in the future. I understand your need to be assured of a confidential treatment of your responses, and so I guarantee you that your name will not be associated with your answers in any way.

Should you have any questions regarding the nature of this survey, please feel free to call Leigh Beaulieu, Director of ASTS, 1-800-452-2787 or (405) 744-7895; Dr. Jim Choike, AP Calculus By Satellite professor, 1-800-445-7891; or Dr. Connie Lawry, my thesis advisor, (405) 744-5647. For questions related to the questionnaire, please call me at (405) 744-7895, or (405) 744-3560.

Your opinion about the ASTS mathematics course in which your school participated is extremely valuable to Dr. Choike and to Oklahoma State University. I thank you in advance for your cooperation.

Sincerely,

José R. López

Jose Rafael Lopez-Islas

ASTS graduate assistant and OSU graduate student.

AP Calculus By Satellite Schools Questionnaire

DIRECTIONS:

Your completion of this questionnaire can be helpful for future students of **AP Calculus By Satellite**. Your frank responses, and those of other school administrators, will be used to make improvements to the course. Your answers will be processed with strict respect for your anonymity, and the results of the study will be published without mention of names or other information that could trace your answers to you.

Please follow the specific directions for each section. Although the questionnaire is relatively long, it is not complicated. We estimate it will take you approximately ten minutes to complete it. Once you have completed all the questions, please return the questionnaire to us using the enclosed postage-paid envelope. If you have any questions regarding this survey, please call Jose Rafael Lopez at Oklahoma State University, Arts and Sciences Teleconferencing Service, 1-800-452-2787 or (405) 744-7895.

Thank you for your time and your candor.

1. Please mark the school years in which your school has taken **AP Calculus By Satellite.**

   ❑ 1987-1988 ❑ 1988-1989 ❑ 1989-1990 ❑ 1990-1991 ❑ 1991-1992

2. Please list other ASTS course(s) your school has taken and specify the year(s) in which each course was taken:

   a. _____ Year(s): _____

   b. _____ Year(s): _____

   c. _____ Year(s): _____

   d. _____ Year(s): _____

   e. _____ Year(s): _____

   f. _____ Year(s): _____

   g. _____ Year(s): _____

AP Calculus By Satellite Schools Questionnaire

3. Is your school currently taking **AP Calculus By Satellite**?

❑ Yes, the school is currently taking **AP Calculus By Satellite.**

(Please go to question # 4 on this page)

❑ No, the school is not currently taking **AP Calculus By Satellite.**

(Please go to question # 7 on next page)

4. Please indicate the number of students currently enrolled in **AP Calculus By Satellite.** _____ students.

5. Please mark the point on the scale that best represents the importance of each of the following as a reason why your school is currently participating in **AP Calculus By Satellite:**

	Most important				Least important	Not applicable
Previous experiences with the course were satisfactory	❑	❑	❑	❑	❑	❑
The school received a grant to participate in courses by satellite	❑	❑	❑	❑	❑	❑
The school does not have certified teachers who can teach a course like this one	❑	❑	❑	❑	❑	❑
There are students who want to take an advanced placement course like this one	❑	❑	❑	❑	❑	❑
The teaching partner program helps to develop mathematics teachers for the school	❑	❑	❑	❑	❑	❑

AP Calculus By Satellite Schools Questionnaire

Other reasons for taking **AP Calculus By Satellite** (please indicate as many as applicable):

_____

_____

_____

_____

6. For how many more years does your school plan to take **AP Calculus By Satellite**?:

- ❑ None
- ❑ One more year
- ❑ Two more years
- ❑ Three or more years
- ❑ I do not know

Please skip to question # 9 on page 4.

7. Please mark the point on the scale that best represents the importance of each of the following as a reason why your school is not currently participating in **AP Calculus By Satellite:**

	Most important				Least important	Not applicable
Previous experiences with the course were unsatisfactory	❑	❑	❑	❑	❑	❑
The school did not receive new funds to take courses via satellite	❑	❑	❑	❑	❑	❑
The school now has certified teachers who can teach a similar course	❑	❑	❑	❑	❑	❑

AP Calculus By Satellite Schools Questionnaire

	Most important				Least important	Not applicable
There are no students who want to take an advanced placement course like this one	❑	❑	❑	❑	❑	❑
The school cannot afford the cost of this course	❑	❑	❑	❑	❑	❑
The school decided to offer fewer courses in mathematics	❑	❑	❑	❑	❑	❑

Other reasons for not taking **AP Calculus By Satellite** (please indicate as many as applicable):

_____

_____

_____

_____

8. Does your school plan to take **AP Calculus By Satellite** in the future?

Definitely yes	Probably yes	Probably no	Definitely no	I don't know
❑	❑	❑	❑	❑

9. Please list those mathematics courses that your school teaches now, that **were not taught** before your school began to participate in **AP Calculus By Satellite**. Please provide the complete name of each course.

a. _____

b. _____

c. _____

d. _____

e. _____

AP Calculus By Satellite Schools Questionnaire

10. Does your school have one (or more) former **AP Calculus By Satellite** teaching partners currently teaching mathematics?

- ❑ Yes
- ❑ No
- ❑ I do not know

11. Please mark the point on the scale that best represents your answer to the question:

How do you rate **AP Calculus By Satellite** in terms of...?

	Very good		Fair		Very poor
Quality of written materials (course guides)	❑	❑	❑	❑	❑
Teaching partner training	❑	❑	❑	❑	❑
Relevance of the course content	❑	❑	❑	❑	❑
OSU professor performance	❑	❑	❑	❑	❑
Access to OSU professor or staff for advice	❑	❑	❑	❑	❑
Quality of television broadcasts	❑	❑	❑	❑	❑
Student knowledge of Calculus after taking the course	❑	❑	❑	❑	❑

For questions 12 and 13, please mark the point on the scale that best represents your agreement or disagreement with the statement.

12. A student can learn as much calculus in **AP Calculus By Satellite** as in a conventional calculus course (a certified teacher working directly with the students).

Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
❑	❑	❑	❑	❑

AP Calculus By Satellite Schools Questionnaire

13. **AP Calculus By Satellite** has helped this school to improve its mathematics curriculum.

Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
❑	❑	❑	❑	❑

14. Please, mark the point on the scale that best represents your response to the following statement:

In general, I consider that our school's experience with **AP Calculus By Satellite** has been:

Very Satisfactory	Satisfactory	Uncertain	Unsatisfactory	Very Unsatisfactory
❑	❑	❑	❑	❑

15. Please list below any suggestions you may have to improve **AP Calculus By Satellite**:

_____

_____

_____

_____

_____

_____

Please tell us about your school . . .

16. Number of students in the high school: _____

17. Number of grades in high school:_____

18. Approximate number of high school students taking mathematics courses: _____

AP Calculus By Satellite Schools Questionnaire

19. Number of certified mathematics teachers in the school: _____

20. Does the school receive a grant to take ASTS courses?

❑ No ❑ Yes. Please specify (Star Schools, etc.)

_____

21. Please list all the mathematics courses the school is offering this school year.

a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

g. _____

h. _____

Thank you for your cooperation!

January, 1992

Dear school administrator:

I am conducting a research project on Oklahoma State University's Arts and Sciences Teleconferencing Service (ASTS). This study attempts to follow up with schools that have participated in ASTS mathematics courses.

The results of the study will be the basis for my master's degree thesis. Additionally, a report will be presented to the ASTS administration and faculty, who have kindly supported my research effort.

I would appreciate it if you would take a few minutes of your time to answer the enclosed questionnaire, and return it to me in the postage-paid envelope by **February 17, 1992.**

Your frankness in answering the questions is crucial to obtaining information that can be used to improve the courses in the future. I understand your need to be assured of a confidential treatment of your responses, and so I guarantee you that your name will not be associated with your answers in any way.

Should you have any questions regarding the nature of this survey, please feel free to call Leigh Beaulieu, Director of ASTS, 1-800-452-2787 or (405) 744-7895; Dr. John Jobe, Trigonometry By Satellite professor, 1-800-346-4210; or Dr. Connie Lawry, my thesis advisor, (405) 744-5647. For questions related to the questionnaire, please call me at (405) 744-7895, or (405) 744-3560.

Your opinion about the ASTS mathematics course in which your school participated is extremely valuable to Dr. Jobe and to Oklahoma State University. I thank you in advance for your cooperation.

Sincerely,

José R. López

Jose Rafael Lopez-Islas

ASTS graduate assistant and OSU graduate student.

Trigonometry/Analytic Geometry By Satellite Schools Questionnaire

DIRECTIONS:

Your completion of this questionnaire can be helpful for future students of **Trigonometry/ Analytic Geometry By Satellite**. Your frank responses, and those of other school administrators, will be used to make improvements to the course. Your answers will be processed with strict respect for your anonymity, and the results of the study will be published without mention of names or other information that could trace your answers to you.

Please follow the specific directions for each section. Although the questionnaire is relatively long, it is not complicated. We estimate it will take you approximately ten minutes to complete it. Once you have completed all the questions, please return the questionnaire to us using the enclosed postage-paid envelope. If you have any questions regarding this survey, please call Jose Rafael Lopez at Oklahoma State University, Arts and Sciences Teleconferencing Service, 1-800-452-2787 or (405) 744-7895.

Thank you for your time and your candor.

1. Please mark the school years in which your school has taken **Trigonometry/Analytic Geometry By Satellite.**

   ❑ 1987-1988 ❑ 1988-1989 ❑ 1989-1990 ❑ 1990-1991 ❑ 1991-1992

2. Please list other ASTS course(s) your school has taken and specify the year(s) in which each course was taken:

   a. _____ Year(s): _____

   b. _____ Year(s): _____

   c. _____ Year(s): _____

   d. _____ Year(s): _____

   e. _____ Year(s): _____

   f. _____ Year(s): _____

   g _____ Year(s): _____

Trigonometry/Analytic Geometry By Satellite Schools Questionnaire

3. Is your school currently taking **Trigonometry/Analytic Geometry By Satellite**?

❑ Yes, the school is currently taking **Trigonometry/Analytic Geometry By Satellite. (Please go to question # 4 on this page)**

❑ No, the school is not currently taking **Trigonometry/Analytic Geometry By Satellite. (Please go to question # 7 on next page)**

4. Please indicate the number of students currently enrolled in **Trigonometry/Analytic Geometry By Satellite.** _____ students.

5. Please mark the point on the scale that best represents the importance of each of the following as a reason why your school is currently participating in **Trigonometry/Analytic Geometry By Satellite:**

	Most important				Least important	Not applicable
Previous experiences with the course were satisfactory	❑	❑	❑	❑	❑	❑
The school received a grant to participate in courses by satellite	❑	❑	❑	❑	❑	❑
The school does not have certified teachers who can teach a course like this one	❑	❑	❑	❑	❑	❑
There are students who want to take an advanced placement course like this one	❑	❑	❑	❑	❑	❑
The teaching partner program helps to develop mathematics teachers for the school	❑	❑	❑	❑	❑	❑

Trigonometry/Analytic Geometry By Satellite Schools Questionnaire

Other reasons for taking **Trigonometry/Analytic Geometry By Satellite** (please indicate as many as applicable):

_____

_____

_____

_____

6. For how many more years does your school plan to take **Trigonometry/Analytic Geometry By Satellite?**:

❑ None

❑ One more year

❑ Two more years

❑ Three or more years

❑ I do not know

Please skip to question # 9 on page 4.

7. Please mark the point on the scale that best represents the importance of each of the following as a reason why your school is not currently participating in **Trigonometry/Analytic Geometry By Satellite:**

	Most important				Least important	Not applicable
Previous experiences with the course were unsatisfactory	❑	❑	❑	❑	❑	❑
The school did not receive new funds to take courses via satellite	❑	❑	❑	❑	❑	❑
The school now has certified teachers who can teach a similar course	❑	❑	❑	❑	❑	❑

Trigonometry/Analytic Geometry By Satellite Schools Questionnaire

	Most important				Least important	Not applicable
There are no students who want to take an advanced placement course like this one	❑	❑	❑	❑	❑	❑
The school cannot afford the cost of this course	❑	❑	❑	❑	❑	❑
The school decided to offer fewer courses in mathematics	❑	❑	❑	❑	❑	❑

Other reasons for not taking **Trigonometry/Analytic Geometry By Satellite** (please indicate as many as applicable):

_____

_____

_____

_____

8. Does your school plan to take **Trigonometry/Analytic Geometry By Satellite** in the future?

Definitely yes	Probably yes	Probably no	Definitely no	I don't know
❑	❑	❑	❑	❑

Trigonometry/Analytic Geometry By Satellite Schools Questionnaire

9. Please list those mathematics courses that your school teaches now, that **were not taught** before your school began to participate in **Trigonometry/Analytic Geometry By Satellite**. Please provide the complete name of each course.

a. _____

b. _____

c. _____

d. _____

e. _____

10. Does your school have one (or more) former **Trigonometry/Analytic Geometry By Satellite** teaching partners currently teaching mathematics?

❑ Yes

❑ No

❑ I do not know

11. Please mark the point on the scale that best represents your answer to the question:

How do you rate **Trigonometry/Analytic Geometry By Satellite** in terms of...?

	Very good				Very poor
Quality of written materials (course guides)	❑	❑	❑	❑	❑
Teaching partner training	❑	❑	❑	❑	❑
Relevance of the course content	❑	❑	❑	❑	❑
OSU professor performance	❑	❑	❑	❑	❑
Access to OSU professor or staff for advice	❑	❑	❑	❑	❑
Quality of television broadcasts	❑	❑	❑	❑	❑
Student knowledge of Trigonometry/Analytic Geometry after taking the course	❑	❑	❑	❑	❑

Trigonometry/Analytic Geometry By Satellite Schools Questionnaire

For questions 12 and 13, please mark the point on the scale that best represents your agreement or disagreement with the statement.

12. A student can learn as much trigonometry/analytic geometry in **Trigonometry/Analytic Geometry By Satellite** as in a conventional trigonometry/analytic geometry course (a certified teacher working directly with the students).

Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
❑	❑	❑	❑	❑

13. **Trigonometry/Analytic Geometry By Satellite** has helped this school to improve its mathematics curriculum.

Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
❑	❑	❑	❑	❑

14. Please, mark the point on the scale that best represents your response to the following statement:

In general, I consider that our school's experience with **Trigonometry/Analytic Geometry By Satellite** has been:

Very Satisfactory	Satisfactory	Uncertain	Unsatisfactory	Very Unsatisfactory
❑	❑	❑	❑	❑

15. Please list below any suggestions you may have to improve **Trigonometry/ Analytic Geometry By Satellite**: (Continue in next page, if needed).

_____

_____

_____

Trigonometry/Analytic Geometry By Satellite Schools Questionnaire

_____

_____

_____

Please tell us about your school . . .

16. Number of students in the high school: _____

17. Number of grades in high school:_____

18. Approximate number of high school students taking mathematics courses: _____

19. Number of certified mathematics teachers in the school: _____

20. Does the school receive a grant to take ASTS courses?

❑ No ❑ Yes. Please specify (Star Schools, etc.)

_____

21. Please list all the mathematics courses the school is offering this school year.

a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

g. _____

h. _____

Thank you for your cooperation!

January, 1992

Dear former ASTS student:

As I told you in a recent letter, I am conducting a research project on Oklahoma State University's Arts and Sciences Teleconferencing Service (ASTS). This study attempts to follow up former ASTS mathematics students, in order to obtain their opinions about the courses and to get an idea of what they are doing now.

I would appreciate it if you would take a few minutes of your time to answer the enclosed questionnaire, and return it to me in the postage-paid envelope by **February 15, 1992.** If you have already sent it to me, please disregard this letter.

Your frankness in answering the questions is crucial to obtaining information that can be used to improve the courses in the future. I understand your need to be assured of a confidential treatment of your responses, and so I guarantee you that your name will not be associated with your answers in any way.

Should you have any questions regarding the nature of this survey, please feel free to call Leigh Beaulieu, Director of ASTS, 1-800-452-2787 or (405) 744-7895; Dr. Jim Choike, 1-800-445-7891; or Dr. Connie Lawry, my thesis advisor, (405) 744-5647. For questions related to the questionnaire, please call me at (405) 744-7895, or (405) 744-3560.

I thank you in advance for your cooperation.

Sincerely,

Jose R. López-Islas

Jose Rafael Lopez-Islas

ASTS graduate assistant and OSU graduate student.

January, 1992

Dear former ASTS student:

As I told you in a recent letter, I am conducting a research project on Oklahoma State University's Arts and Sciences Teleconferencing Service (ASTS). This study attempts to follow up former ASTS mathematics students, in order to obtain their opinions about the courses and to get an idea of what they are doing now.

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I thank you in advance for your cooperation.

Sincerely,

José R. López-Islas

Jose Rafael Lopez-Islas

ASTS graduate assistant and OSU graduate student.

APPENDIX C

RESEARCH PROJECT APPROVAL BY THE OKLAHOMA STATE UNIVERSITY INSTITUTIONAL REVIEW BOARD FOR HUMAN SUBJECTS RESEARCH

OKLAHOMA STATE UNIVERSITY
INSTITUTIONAL REVIEW BOARD
FOR HUMAN SUBJECTS RESEARCH

Proposal Title: Multilevel Followup Study of OSU's Arts and Sciences Teleconferencing Services Courses in Mathematics

Principal Investigator: C. Lawry/J. Lopez-Islas

Date: 12-2-91 IRB # AS-92-020

This application has been reviewed by the IRB and

Processed as: Exempt [x] Expedite [ ] Full Board Review [ ]

Renewal or Continuation [ ]

Approval Status Recommended by Reviewer(s):

Approved [x] Deferred for Revision [ ]

Approved with Provision [ ] Disapproved [ ]

Approval status subject to review by full Institutional Review Board at next meeting, 2nd and 4th Thursday of each month.

Comments, Modifications/Conditions for Approval or Reason for Deferral or Disapproval:

Signature: _____ Date: 12-4-91
Chair of Institutional Review Board

VITA

José Rafael López-Islas

Candidate for the Degree of

Master of Science

Thesis: A MULTI-LEVEL FOLLOW-UP STUDY OF THE OKLAHOMA STATE UNIVERSITY'S ARTS AND SCIENCES TELECONFERENCING SERVICE (ASTS) COURSES IN MATHEMATICS

Major Field: Mass Communication

Biographical:

Personal Data: Born in Monterrey, Nuevo León, México, August 18, 1960, the son of Cipriano López and María Dolores Islas de López.

Education: Graduated from Colegio México, Orizaba, Veracruz, México, in June, 1978; received Bachelor of Science Degree in Mass Communication from the Instituto Tecnológico y de Estudios Superiores de Monterrey, Campus Monterrey, México in June, 1982; completed requirements for the Master of Science degree at Oklahoma State University in May, 1992.

Professional experience: Faculty member, Department of Communication, and director of the Undergraduate Program in Communication, Instituto Tecnológico y de Estudios Superiores de Monterrey, México, August, 1983 to July, 1990.