

THE UTILIZATION OF NASA CURRICULUM MATERIALS
BY EDUCATORS OF STUDENTS WITH LIMITED
ENGLISH PROFICIENCY

By

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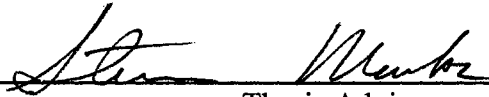
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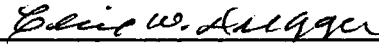
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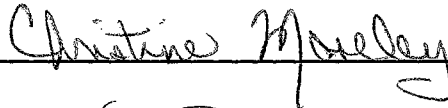
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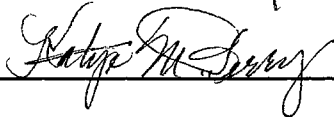
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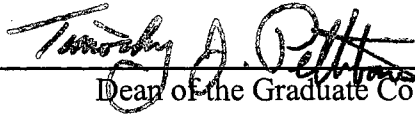


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CHAPTER I

INTRODUCTION

In the 1990s, the United States was faced with the task of reforming its educational system to improve the competitiveness of our nation in the world community. In response, the National Aeronautics and Space Administration (NASA) developed efforts to collaborate and contribute to reforming the nation's educational system. Today, NASA develops, utilizes, and disseminates science, mathematics, technology, engineering, and geography instructional products to support the systemic change in those areas of instruction. NASA uses a unique system that supports the local, state, regional, and national levels in efforts to collaborate with internal and external stakeholders on education issues. Because education is a state and local issue, NASA is seeking ways to understand the individual needs in order to provide the best support in the areas most needed (Implementation Plan, 1999-2000).

NASA's educational vision is to promote educational excellence: "We involve the educational community in our endeavors to inspire America's students, create learning opportunities and enlighten inquisitive minds" (NASA Strategic Plan 1998).

At present, NASA conducts large and diverse sets of educational programs that span the elementary to postdoctoral levels (Tripp, 1998). These programs have developed over the years and have evolved into the following programs:

- Aerospace Education Services Program (AESP)
- NASA Education Workshops (NEW)
- Urban Community Enrichment Program (UCEP)

The Urban Community Enrichment Program (UCEP) is a NASA educational program that has been specifically designed to serve elementary and middle school teachers and students from urban communities across the country including the U.S. Virgin Islands, Puerto Rico, and Guam. Teachers are introduced to NASA teacher enhancement products by participating in the UCEP workshops.

In the past, several studies have been conducted to provide information concerning NASA teacher workshops. The following studies have addressed:

- The effectiveness of NASA Urban Community Enrichment Program teacher workshops
- The utilization of aerospace concepts by Elementary Workshops participants
- Feedback of participants after attending a summer aerospace workshop
- The relationship between aerospace workshops and practices and attitudes of participating teachers.

Statement of the Problem

UCEP was designed to provide curriculum support to under represented communities as well as to better assist teachers in their use of the NASA curriculum. In addition, UCEP was designed to provide teachers with more professional development opportunities.

During the 1996-2000 academic year, UCEP conducted programs in nine cities whose student population was equal to or greater than 50 percent Hispanic. A majority of the core teacher workshop participants had been educators of LEP students. It was with great interest and concern that the bilingual community be included in the reforming efforts to uplift and enhance the instructional and curriculum support in efforts to increase minority participation in the areas of science, mathematics, technology and geography. However, studies have not shown whether educators of LEP students are using NASA teacher enhancement products in their curriculum. More specifically, it is not known how educators of LEP students are utilizing NASA curriculum as it relates to concepts, subject matter, activities in the classroom, and curriculum development strategies.

Purpose of the Study

Today, we face a growing bilingual community that will exceed the national expectation and preparation. Demographic data indicate tremendous increases in language minority students, and that trend is projected to continue. It is expected that Hispanics both native born and immigrants will be the majority of the minorities within the next 30 years. In 1990, The Hispanic Policy Development Project (HPDP) has projected the following U.S. Hispanic population figures:

- 1990: 22,024,000
- 1995: 27,692,000
- 2000: 34,818,00

These numbers are projected to grow according the U.S. Census Bureau. Hispanic Americans are the fastest growing demographic group in the United States. According to

Census 2000, their number increased by 58 percent since 1990 – a gain of about 13 million people. Hispanics made up 12.5 percent of the population in 2000. Large numbers of Latin American immigrants and robust fertility rates have caused this growth. In 2000, Hispanics were the largest minority group, numbering 35.3 million individuals, slightly larger than the African American population (34.7 million). By the year 2025, Hispanic Americans will account for 18 percent of the U.S. population. If current demographic trends continue, the Hispanic population will almost triple by 2050; one out of every four Americans will be Hispanic. These numbers will continue to grow according to the U.S. Census (2000) who reveals that the United States is the fourth largest Spanish speaking country in the world (Carreira, 2000). Consequently, this increase will enhance the number of Hispanics and immigrants that learn and speak English over a period of the time (Santiestevan, 1991). Unfortunately, due to the rapid growth, our education systems are faced with teaching limited English proficient (LEP) students in a way that is understandable and meaningful to a multicultural population (Sutman, 1993).

As a result of these increases, it is urgent that provisions are in place and instructional products are at the disposal of educators of LEP students within the sciences. In 1999, the National Center for Bilingual Education (NCBE), reported that the number of students classified as LEP has doubled since 1989, from about 2 million to over 4 million. Overwhelmingly, while language minority students have received minimal encouragement to develop their home language, leaders in business, industry, and government decry the lack of linguistic and cultural literacy among the U.S. workforce necessary for a global economy (College Placement Council (CPC), 1994; Fradd & Lee, 1998). Therefore, the purpose of this study is to determine how and to what extent

educators of LEP students make use of NASA teacher curriculum concepts, subject matter, incorporate the concepts in the classroom, and integrate content in classroom instruction.

Research Questions

In order to determine the utilization of NASA curriculum by educators of LEP students and its impact of classroom instruction, the following research questions have been designed.

1. What are the background characteristics of educators of LEP students who attended UCEP workshops from the 1996-2000 academic years in reference to the following: gender, current teaching level, primary position in the school, number of years teaching, type of school in which they teach, number of students per class, the dates they were involved in the UCEP workshops and any teacher participation in previous aerospace related workshops?
2. How often were the NASA curriculum materials utilized in the bilingual classroom instruction?
3. Have the NASA curriculum materials, or the content or skills portrayed in the materials increased educators' of LEP students use of science, mathematics, technologies and geography?
4. What is the user's (educators' of LEP students) perception of the quality and utility of the materials as it applies to bilingual instruction and learner characteristics?

5. Of your LEP students how would you rate their ability to fully participate using NASA curriculum related activities?
6. Of the NASA curriculum materials used describe how the materials helped you better facilitate learning to LEP students?
7. How have the NASA curriculum materials been incorporated to LEP students in classroom instruction?
8. What NASA resources were changed to better help facilitate learning for LEP students ?
9. How can NASA better serve bilingual education as it applies to instruction, content, and curriculum support?

Definition of Terms

Aerospace Workshop – A forum for a group of teachers that focuses on training with curriculum support materials and hands-on activities.

AESP – Aerospace Education Services Program, educational program designed to support the efforts of NASA to initiate and sustain dramatic and enduring education reforms for science, mathematics, and technology and to improve and upgrade the scientific, mathematical, and technological literacy of all students (NASA, 2000).

BEA – Bilingual Education Act: A federal education program specifically intended for limited English proficient children.

Educators of Limited English Proficient Students – Teachers that participated in the NASA/UCEP program during the 1996-2000 academic years

ESEA – Elementary and Secondary Education Act: A title I program for educationally disadvantaged children.

ESL – English as a Second Language: Refers to English language learning in countries where English is the main and /or official language, and the student's own native language (first language) is not English.

LEP – Limited English Proficiency: Individuals who have a limited ability to read, speak, or understand English.

NASA – National Aeronautics and Space Administration.

Proposition 203 – An initiative adopted by Arizona voters, November 7, 2000 that requires that all public school instruction be conducted in English. Children not fluent in English are placed in an intensive one-year English immersion program to teach them the language as quickly as possible while also learning academic subjects.

Proposition 227 – An initiative that eliminates the local school districts' ability to choose an educational policy with respect to LEP children. Mandates a uniform solution for all LEP in the state of California (Blake, 2000).

Teacher Enhancement Products – A term used to describe instructional material such as workbooks, references and online resources.

UCEP – Urban Community Enrichment Program, a NASA aerospace education service program specifically designed to serve middle school students in urban areas.

Significance of the Study

At present, NASA's teacher enhancement products are delivered to participants in the English language only. This study should provide data that address the extent to

which educators of LEP students are provided relevant information leading to the development of more language proficient products and enhance the limited materials currently provided through the UCEP program. NASA's educational programs provide an array of teacher enhancement products to support the curriculum efforts in school systems all over the country. To this end, the results of this study could inform developers of the NASA curriculum about areas in need of change to better meet the needs of educators who provide instruction for students with limited English proficiency.

Assumptions

The assumptions of this research imply the following:

- The materials that are being distributed are being utilized.
- The selected UCEP workshop academic years 1996 – 2000 are representative of previous UCEP workshops held.
- Educators of LEP students responded honestly to the questionnaire.
- The educators are directly responsible for the instruction of LEP students.

Limitations

This study depended on the voluntary responses from educators of LEP students. The researcher used survey techniques based upon available methodologies and current research. Only participants during the academic years of 1996 through 2000 were included in the study. Therefore, delayed recall becomes a limitation of this study.

Organization of the Study

Chapter I presented the introduction and statement of the problem, the purpose, definition of terms, the significance, and assumptions and limitations of the study.

Chapter II forms the foundation of the study by presenting a discussion of the review of relevant literature on the utilization of instructional materials by educators of LEP

students and research questions. Chapter III provides the methodology and the research design for the study. Chapter IV presents the analyses of the data collected in the study.

Chapter V includes the summary of the study, findings, conclusions and recommendations.

CHAPTER II

REVIEW OF LITERATURE

Introduction

This chapter contains a review of the literature that is related to the problem. The review of literature addresses the following areas:

1. Overview of bilingual education in the United States
2. Multicultural education
3. Teaching science and mathematics effectively to LEP students
4. Reform and reporting challenges that affect limited English speaking students
5. Description NASA curriculum materials
6. NASA's involvement in education and the Urban Community Enrichment Program
7. Selected aerospace studies
8. Summary
9. List of Research Questions

Overview of Bilingual Education in the United States

More world languages are spoken in the United States today than ever reported before. A focus on non-English language speakers were common in the 19th century reflected by laws authorizing native language instruction in a dozen states and territories (Crawford, 1998). In larger cities and rural areas, students attended bilingual and non-English schools, learning several different languages. In 1900, there were at least 600,000 elementary school children receiving part or all of their instruction in German (Kloss, 1998).

The number of bilinguals fluent in both English and another language is growing at a phenomenal rate. Between 1980 and 1990, the number of immigrants who spoke non-English languages at home increased by 59 percent, while the portion of this population that spoke English very well rose by 93 percent (Waggoner, 1995).

Focusing on the status of Hispanic Americans as the nation's fastest growing population group, it is important to recognize various aspects of the population. Foreign-language instruction has not entered the lives of many K-12 students in the United States (American Council on the Teaching of Foreign Languages, 1996) despite the increase in the number of Spanish-speaking immigrant children and adolescents in the United States. In 1989, the nation's Hispanic population was estimated to be 20.1 million, a 39 percent increase over the 1980 census figure of 14.5 million (Santiestevan, 1991). The rate of increase for the total United States population was 9.5 percent, but for the non-Hispanic population it was 7.5 percent (Santiestevan, 1991). About three in four Hispanic

immigrants, after 15 years in the United States, speak English on a daily basis, while 70 percent of their children become dominant or monolingual in English (Veltman, 1983).

Research over the past two decades has determined that, despite appearances, it takes children a long time to attain full proficiency in a second language. Often, they are quick to learn the conversational English used on the playground, but normally they need several years to acquire the cognitively demanding, decontextualized language used for academic pursuits (Collier & Thomas, 1989). Bilingual education programs that emphasize a gradual transition to English and offer native-language instruction in declining amounts over time provide continuity in children's cognitive growth and lay a foundation for academic success in the second language (Crawford, 1998). In contrast, bilingual programs that provide English-only instruction can produce negative effects and hinder growth and achievement.

In the past, changes have been made to increase the number of U.S. bilingual education projects. The U.S. Department of Education (ED) administers the Bilingual Education Act (BEA), the federal education program specifically intended for limited English proficient children. The BEA, among other things, authorizes competitive grants for local school districts to help them in educating elementary and secondary LEP students. The BEA supports nearly 1000 projects nationwide. In total, there are an estimated 3.4 million LEP children in the United States with only 12 percent served in BEA projects. Most LEP children are served in local, state, and other federal programs that address, at least in part, their special educational needs. These programs utilize a wide array of instructional models for LEP children. Although conceptually distinct, many of these models are difficult to distinguish in practice. Fundamentally, these models

may be differentiated by the role of the child's native language. At one end of the spectrum, *bilingual education* projects use the native language for both English acquisition and academic learning in all subjects. Toward the other end of the spectrum, *English as a Second Language (ESL)*, *sheltered English*, and *immersion* projects may place very little emphasis on the native language while expecting a relatively rapid grasp of English. According to the most recent estimates available, states spend at least \$690 million on LEP children for bilingual education and ESL training. The Elementary and Secondary Education Act (ESEA) Title I program for educationally disadvantaged children is reported to reach 1.5 million LEP students (Krashen, 2000). In June 1998, California voters passed Proposition 227, a measure that eliminates public bilingual education programs in that state. Previously, California students were provided an array of programs to assist students who were learning English. All schools had English as a Second Language classes, but some used English exclusively for instruction while others also had bilingual instruction in which native languages were used to teach basic subjects while the students learned English. Proposition 227 replaced this flexibility with a one year program in which all subjects are taught in English unless there are special student cases. Therefore, all students will be obliged to learn English in one year. Advocates of Proposition 227 argued that bilingual education programs in California are havens for poor instruction and lower achievement (Garcia, 2000). Supporters report that educating children in their first language helps their acquisition of another language (Garcia, 2000).

National and international research show that bilingualism and biliteracy have beneficial psycho-cognitive results. Immigrant students of Hispanic descent who are

bilingual and attend bilingual programs do much better academically than those who speak English only (Garcia, 2000).

A number of studies have shown that bilingual education is effective, with children in well-designed programs acquiring academic English as well and often better than children in all-English programs (Cummins, 1989; Greene, 1997; Krashen, 1996; Willig, 1985). Willig concluded that the better the experimental design, the more positive were the effects of bilingual education (Krashen, 2000).

In Arizona, voters passed Proposition 203 on November 7, 2000 by a two to one margin, replacing bilingual education with English immersion for most students learning the language. It is an initiative statute that prohibits native-language instruction for most limited-English-proficient children in public schools. The law states that parents may request a bilingual education waiver if the student:

- already speaks English
- is 10 years old or older
- has spent at least 30 days in an English language classroom and is found to have special physical or psychological needs above and beyond a lack of English proficiency

Congressional interest in the BEA centers on the appropriate federal role in meeting the special needs of the LEP population. In particular, attention is focusing on questions such as the role of the native language in instructing LEP children, how long it takes LEP students to master English, and the impact of California Proposition 227 and Arizona's Proposition 203 on bilingual education policy. In the 105th Congress, there were bills introduced proposing either to eliminate or amend the BEA. The Congress

considered several proposals to reauthorize the BEA in the 106th Congress.

Congressional consideration of the BEA, as part of the ESEA reauthorization, is expected to intensify in the 107th Congress. It is anticipated that issues surrounding the schooling of LEP children will continue to develop as their authorization discussions continue (U.S. Department of Education, 2001).

Multicultural Education

During the 1960s, the United States' multicultural education faced a strong resistant from parents of various subordinate groups (ethnic, racial, religious, and economic) who wanted their children to be free from the protestant-dominated Northern European school system. African American and Latino parents were at odds with the gap between what they wanted for their children and what the school system provided for the control of schools. This was critical to re-shaping contemporary multicultural education in the United States. In the nineteenth century the prevailing dominant-subordinate groups used schools as a place to integrate and socialize children of various cultures; supported boarding schools as means to break the cultural and tribal bonds of Native Americans; while excluding as much as possible African Americans, who sought entrance into the education system as a way getting good jobs; while largely ignoring hundreds of years of Hispanic presence and influence in America (LaBelle & Ward, 1996).

The nature of multicultural education suggests an approach to curriculum development and program delivery with the recognition of the diversity of cultural differences that exist in a pluralistic society and an endorsement of a society in which

individuals of all cultures are accepted and given respect. Thus, it encourages a positive acceptance of races, religions and cultures, and recognizes diversity. “Curriculum should be determined by what is in the community and that education should begin with the language of the community and that education should begin with the language of the community and experience of the children” (Murillo, 1996).

In 1993, educator Mary M. Atwater wrote a seminal article where she defines multicultural science education as “a field of inquiry with constructs, methodologies, and processes aimed at providing equitable opportunities for all students to learn quality science in schools, colleges and universities” (Atwater, 1993). She also suggests that the premises in multicultural science education incorporates:

- All students can learn science;
- Every student is worthwhile to have in the science classroom;
- Cultural diversity is appreciated in science classrooms because it enhances rather than detracts from the richness and effectiveness of science learning (Atwater, 1993).

Researchers indicate that students often come to school with many stereotypes, misconceptions and negative attitudes toward outside racial and ethnic groups. (Banks, 1999). Research also indicates that the use of multicultural textbooks, other teaching materials and cooperative teaching strategies can help students to develop more positive racial attitudes and perceptions (Banks, 1999). Teachers can help increase academic achievement of students from different ethnic groups by modifying their instruction so that it draws upon their cultural strengths (Banks, 1999). Cultural groups define success

quite differently from one another and quite differently from the definition of success used in U.S. schools.

Understanding various perspectives is important because cultural differences can influence how teachers view the behaviors of students in classrooms, how children interact with teachers and other adults in the schools, and how parents perceive that school staff are treating their children (Romo, 2001). According to a research study conducted by Susan Phillips, author of *The Invisible Culture: Communication in Classroom and Community on the Warm Springs Indian Reservation*, Phillips observed four classrooms, following students during their school activities, and then informally interviewing teachers about what she had observed, she concluded that students participated more actively in class discussions when teachers used group-oriented participation structures that were consistent with their community cultures (Phillips, 1983). In the classroom, when the teachers tried to organize small-group activities, the Indian children did not participate. When the children were called upon one after another to talk, they often did not respond at all. Children who did not participate in classroom discussions were perceived as not paying attention, lacking motivation, or as less intelligent than the students who met the teachers' expectations of behaviors. Cultural differences affected the teachers' attitudes toward the Indian children and their assessments of the children's capabilities (Romo, 2001).

Recent research work with a Mexican American community-based Head Start Program conducted by Harriett D. Romo, Ph.D., concluded that after observing videotaped parent-child interactions in the homes and then videotaped behavior of the same children in their Head Start classrooms that incompatibilities between the classroom

and cultural home teaching created a disadvantage for children in the classroom. In the home, older children modeled appropriate behaviors and provided a supportive learning environment. For example, book reading took place as a social activity, with older children or an adult helping the student participate. In contrast, in the classroom students were expected to take the initiative for learning, to complete activities by themselves, and learn from verbal instructions (Romo, 2001).

Nowhere is the suppression of cultural identities more evident than in the classroom textbook. In the case of history, social studies, literature, and other discipline-based textbooks, minorities are added into an existing context (McCarthy, 2000). The fragmented approach is demonstrated in the treatment of cultural societies such as Africa, Latin America, and Asia. The editors of *Interracial Books from Children Bulletin* conducted an in-depth review and sampled 71 social studies textbooks used in schools throughout the United States in 1980s and the report concluded the following:

Central America is entirely omitted from many of the most common world geography, history, and “cultures” textbooks used in U.S. classrooms. Thirty-one U.S. history texts were checked for their coverage of Central America. Seven of these do not even mention Central America. Fifteen texts limit coverage of Central America to the building of the Panama Canal, and most of these books ignore or mention only in passing the U.S. military intervention that led to the acquisition of the canal . . . Not one of the 31 texts discusses the continuing involvement of the U.S. government . . . sometimes overt, sometimes covert . . . in Central America.

(McCarthy, 2000)

There are various aspects of multicultural education that require vast improvements in America's schools. Multicultural education must involve a radical rethinking of the nature of school knowledge as knowledge is fundamentally relational and heterogeneous in character (McCarthy, 2000).

In democratic schools, the curriculum reflects the cultures of the diverse groups of people within society, the languages and dialects that students speak are respected and valued, cooperation rather than competition is fostered among students and students from diverse racial, ethnic and social-class groups are given equal status in the school. (Banks, 1999)

Teaching Science and Mathematics

Effectively to LEP Students

In the United States educational system, linguistic diversity is growing. Many middle and high school science and math content area teachers are finding themselves teaching science to ESL students at varying levels of English language proficiency which presents many challenges.

The majority of the United States' bilingual education programs are designed to encourage complete fluency of the English language. Today, a majority of bilingual programs continue to deliver a substantial portion of the curriculum in English (Crawford, 1998). According to one study, school districts reported that 28 percent of Limited English Proficient elementary school students received no native language instruction. Among those who do, one-third received more than 75 percent of their instruction in English; one-third received from 40 to 75 percent in English; and one-third

of these received less than 40 percent in English (Crawford, 1998). The LEP students learn English skills most effectively when they are taught across the curriculum; it is especially productive to integrate science and English teaching (Sutman, 1993). A combined curriculum teaching science using methods that are more understandable and meaningful to multicultural students increases English language proficiency. Such a curriculum can be tailored for students at all educational levels and does not dictate that educators be knowledgeable of the students' native languages.

While much of the science curricula currently in use is not effective for limited English proficient students, new teaching methods and curricula are being developed that show great promise in their ability to provide students with good education in both Science and English (Sutman, 1993). Schools with large Hispanic LEP students and other minority populations habitually clustered these students into low ability tracks without consideration of their actual ability or potential for academic success. The result of this discriminatory practice is the severe underrepresentation of minorities in advanced science and mathematics classes, and thus, in careers requiring advanced level science or math skills (Sutman, 1993). A major goal in science education to LEP students is to develop students' ability to interpret and apply what they have learned. Memorizing facts may result in earning good grades on standardized tests, and high marks on tests provided by traditional teaching methods that focus on discrete facts but real learning requires the ability to understand, not just to repeat course material. Thus instructional techniques must instill development of thinking skills as well as acquisition of science information .

In a study conducted at Eastern University on *Linguistically Responsive Science Teaching*, the researcher outlines two linguistic considerations science teachers need to

understand in order provide effective science instruction speakers of non-English: A basic understanding of the second language acquisition and a variety of linguistic nuances in the language of science and the linguistic considerations to teach science standards to all students, as outlined in the 1996 National Science Education Standards (Shaw, 2002). The study provided key findings in regards to science language, National Science Education Standards (NSES), and teaching strategies that help limited speaking English students in the science classroom.

In the late 1980s and early 1990s science education in the United States was said to be “less than adequate” (Buxton, 1998, p. 343). Reports indicated that science education focused on memorization, lectures, demonstrations and assessments through objective testing with little opportunity for students to engage directly in open-ended inquiry-based learning and not representing the true nature of science. This criticism led to the overhaul of National Science Education Standards (NSES) in 1996. What proved to be most challenging was the approach to successfully teach science to limited English-speaking students, while adhering to the science standards for all students. According to the study, teaching the new science standards to linguistically challenged students would require new teaching approaches and considerations to help science teachers of English as a Second Language Students (ESL). The study provided the following considerations when teaching with second language learners:

- A child learns a second language by using the semantics of the native language as a foundation

- The view of second language acquisition can be successfully utilized in science classrooms where an ESL student's first language is of a Greco-Latin origin.

This practice allows students to use skills such as context clues or word recognition to help define scientific words with Latin origin (e.g. "Carnivore" which means meat eater in Spanish means carne means meat) rely heavily on Greco-Latin culture (Shaw, 2002). In a similar study, various instructional strategies have been proven to be most effective for teaching science to LEP students:

- Group Instructional Classroom Organization – Cooperative learning fostering language development through inter-student (and possibly written) communication. In classrooms where LEP students have varying degrees of English language proficiency or come from different language backgrounds, the groups should reflect these variations as much as possible.
- Inquiry-based / Discovery Instruction – In an inquiry-based environment, students have the opportunity to find the answers to the questions they themselves pose about a topic. Students develop their English language skills as they articulate the problems they have devised and in their efforts to solve them, they learn to learn on their own. Students should also be given ample opportunities to test their own ideas. Ideally, teachers should provide a variety of resources to support students; discovery activities: materials for science laboratory investigation; reference books, newspapers and magazines, and access to libraries for additional material;

classroom visits from specialists in the community; field trips; films and computer programs.

- Open-ended discussions – In order for students to formulate ideas and complete thoughts in English, teachers should pose open-ended questions and assistance can take the form of providing references. This approach may result in coverage of less material but students will have a better understanding of the content that is covered and will ultimately learn more because they learned not only science but how to problem solve (Sutman, 1993).

Teaching mathematics to LEP students does not simply require that students be knowledgeable of the language of instruction. Cultural issues are present when addressing instructional methods and practices for language minority students. Instruction of mathematics that emphasizes and incorporates language activities in curricula can benefit LEP students by helping them relate cultural and linguistic ideas to the application of mathematical problems. Within an academic context, a basic proficiency in mathematics is inadequate because language minority students are inexperienced with or lack an understanding of the terminology and writing styles particular to the content area (Short, 1989). Students whose primary language is not the language of instruction have very different needs. Specially designed activities and teaching strategies (developed with the assistance of language specialists) should be incorporated into the high school mathematics program in order for all students to have the opportunity to develop their mathematics potential regardless of the lack of proficiency in the language of instruction (Short, 1989).

Curricula should help students understand the way mathematics can be applied to everyday life and promote English language proficiency. Coursework helps expand learning potential in numerous ways such as the following:

- Integrating Science and Mathematics Teaching – As students pose and solve science problems, they will naturally require use of mathematics, so combining instruction in both subjects, along with English language skill development, reinforces learning of each. Students should use mathematics to answer questions arising from their coursework; solving math problems they themselves have created will help them better appreciate math's practical usefulness. Integration of science, mathematics, and English language learning obviates the need for the common and fragmented English as a Second Language or remedial math “pull-out” instruction that is less effective and stigmatizing for students.
- Instructing with Computers – computers can stimulate ideas that otherwise are very abstract and difficult for the LEP student to understand. Computers should not be used to substitute totally for hands-on experiences. Moreover, research has shown that computer instruction is most effective after students have had some real experiences (Sutman, 1993).

Teaching strategies for many ESL students usually incorporate the use of conversational English. However, many ESL students are not yet proficient in academic English and struggle because adequate learning strategies to succeed are not incorporated

in classrooms, especially in science. The following strategies present a possible assistance for math and science teachers of ESL/LEP students:

The first thing any administration can do to improve educational practices for ESL students in the classroom is to promote collaboration between content area teachers (mainly science) and ESL or language specialists within the school. As Vine (1997) points out in her research, many “specialist ESL classes sometimes focus more on the social, conversational, communicative aspects of English language development rather than academic ones” (p. 8). Buxton (1998) argues that “one of the reasons that the science classroom is not traditionally used as such a [language] resource is the lack of communication between science teachers and language specialists” (p. 342). There is a real need for more collaboration between content area teachers and ESL specialists.

A study conducted by the National Center for Research on Cultural Diversity and Second Language Learning discovered that four schools noted as outstanding in their instructional programs for ESL students shared a common key factor: “their language acquisition and development programs for LEP [limited English proficiency] students support, and are coordinated with, the exemplary science and mathematics programs” (Minicucci, 1996, online). The author noted that the reform towards success began by giving teachers ample opportunities for collaboration, staff development, and time for planning lessons and, in one case, an extra class period was added to the schedule for teachers to meet with students on a small group basis (Shaw, 2002).

Reform and Reporting Challenges That Affect Limited English Speaking Students

It is reported that one in five children in the U.S. schools system comes from a minority household, where the English language is rarely spoken in the home. Unfortunately, this trend is true for many children and often times they enter schools with very Limited English Proficiency (LEP). It is noted that educators have recognized the increasing numbers of LEP students entering the nation's schools. However, the assumption that most LEP students enter schools in the early grades has slowly dissipated. An increasing number of LEP students first enter school in the upper elementary grades and in middle or high school levels. For example, in California, 31 percent of LEP students in 1991 were secondary school students (California State Department of Education, 1991, cited in Lucas, 1993).

In addition, LEP students face a greater challenge in gaining access to academic programs equivalent to those of their peers who are proficient in English. Students who have limited English-speaking abilities are not able to take the academic courses required to graduate from high schools or qualify for college. Such challenges pull the LEP students further apart from obtaining the necessary skills to pursue a career in the scientific and mathematical communities. Basic change in the way science and mathematics are taught have been a cornerstone of the school reform in the U.S. (Anderson, 1994).

As the nation focuses on improving the science and mathematics in schools, the urgency to develop science and mathematic curricula for LEP students is detrimental to

the future of the next generation. Several barriers have evolved in the course of development such as:

- The educational experts who concern themselves with LEP students are not familiar with efforts being made in upgrading science and mathematics learning, and vice versa with experts not familiar with the educating of LEP students.
- The lack of training by faculty members in the science curriculum who give instruction to LEP students in their primary language.
- The lack of systematic time teachers need to plan and implement new curricula (Anderson, 1994).

Public reporting of educational results is becoming an increasingly important tool for ensuring that public schools are accountable for helping students meet higher educational standards. New federal mandates are emphasizing the establishment of on-going reporting systems that include all students, including English language learners. Most states publish reports on student performance. In the past, few publicly reported the educational results of English language learners. Failure to report scores of all students sends the message that some students are not important and that the students do not count. Most state agencies did not even keep track of the rate at which these students participated in testing. Low rates of participation and variability from one place to the next prevents policy-relevant conclusions to be drawn about the extent to which students with limited English proficiency are benefitting from their educational experiences. New federal policies require states to ensure that students with limited English proficiency participate in their assessment systems; they also require public reporting.

These requirements are most evident in The Elementary and Secondary Education Act (ESEA), which supports Title I programs. ESEA requires that programs report student performance on the state assessment, and that the performance of English language learners be desegregated. Public reporting requirements for English language learners with disabilities are also evident in the 1997 reauthorization of the Individuals with Disabilities Education Act (IDEA), which supports special education programs. (National Center on Educational Outcomes, 2002).

Multicultural reform will play an important role in developing, designing and implementing multicultural curriculum into the institutional environment. In order for multicultural curriculum to be fully recognized in schools the following initiatives need to be institutionalized:

- Pre-service teachers education programs at the universities and colleges across the country must systematically incorporate critical multicultural objectives into their curricula and field experience.
- School districts and school principals must set diversity as an explicit goal and seek way to integrate the notion in the organization of the curriculum and the institutional life of schools. Right now, multiculturalism is treated as a side topic, mentioned only during Black History Month and on International Women's Day.
- Multiculturalism should not be limited to the present understanding- that is, the idea that all we need to do is to add some content about minorities and women to the school curriculum. Multiculturalism must involve a radical rethinking of the nature of school knowledge as knowledge that is

fundamentally relational and heterogeneous in character. In this sense, for example, we cannot get a full understanding of the civil rights movement in the United States without studying its multiplier effects on the expansion of democratic practices to excluded groups in Australia, the Caribbean, Africa, England, and the United States itself. Further, we cannot properly understand the direct link between Europe's development and the underdevelopment of the third world. For example, at the time that the French were helping to bankroll the American Revolution, two-thirds of France's export earnings were coming from its exploitation of sugar cane plantations in Haiti.

- In terms of textbooks, there is a need to involve indigenous minority and third world scholars and teachers in the production of school knowledge in the textbook industry at every level-that is, from the level of textbook writing, through editorial and managerial decision making.
- Lastly, . . . the multicultural ethos in schools will only be fully realized when minority and underprivileged students have access to an academic core curriculum that is on par with their middle-class and white counterparts (McCarthy, 2000).

Description of UCEP/ NASA Curriculum Materials

The NASA/UCEP program is designed for grades 5-8. NASA UCEP specialists train core educators as a team to conduct interdisciplinary aerospace activities and provide educational curriculum materials for the educators to utilize upon returning to the

classroom. This section will focus on educational materials distributed by the NASA Urban Community Enrichment Program. NASA/UCEP delivers curriculum support materials via numerous publications such as:

- **Aeronautics: An Educator's Guide with Activities in Science, Mathematics, and Technology Education.** The three chapters are (1)Air, (2)Flight, and (3)We Can Fly, You and I.
- **Liftoff: NASA Educator Guide for Pre-K through 2nd grade** focuses on activities about the International Space Station and the role rockets play in its construction.
- **Rockets: A Teacher's Guide for Rocketry.** Learn about the history, scientific principles and mathematics of Rockets through problem-solving and cooperative learning activities.
- **Suited for Spacewalking:** This guide begins with brief discussions of the space environment, the history of spacewalking, NASA's current spacesuit, and work that astronauts do during spacewalks. These are followed by classroom activities and a design brief that challenges students to design a spacesuit prototype for a Mission to Mars.
- **Teachers and Students Investigating Plants in Space:** Students grow AstroPlants through a life cycle, and in the process will become acquainted with germination, orientation, growth, flowering, pollination, fertilization, embryogenesis and seed development (NASA, 2002).

The educational curriculum materials contain student activities and designed lesson plans that can be utilized cross curriculum and integrated into classroom instruction. More

importantly, NASA curriculum is developed with the idea that through the use of hands-on activities, inquiry-based learning, interactive and cooperative group activities, that all teachers and students regardless of their linguistically challenged environments can benefit from the use of NASA curriculum products.

NASA's Involvement in Education and UCEP

“And I said then and repeat today, education is the single most important issue our generation faces today that will influence our nation's course for the future” (Goldin, 1999, p.1).

Since the inception of the National Aeronautics and Space Administration in 1958, NASA and the nation's education program work hand in hand. The goals of these two entities are cohesive. Exploration, discovery and the pursuit of new knowledge and achievement are interdependent. The success of NASA greatly depends on the educational system producing a knowledgeable work force to perform technological breakthroughs and new innovations. “Likewise, the nation's educational system looks to NASA for inspiration and to exemplify doing things that once were only imaginable - feats that motivate and encourage our students to study science, mathematics, technology, and engineering” (Goldin, 1999, p.1).

As stated in the NASA Strategic Plan 1999, NASA's vision consists of several specific outcomes from the activities that contribute to the advancement of science and technology. “Educational Excellence: We involve the educational community in our endeavors to inspire America as students, create learning opportunities and enlighten the inquisitive minds” (NASA Strategic Plan 1998). “The NASA mission

is unique and gives teachers and students an opportunity in which to participate in a visible, tangible example of using science and technology to achieve national goals” (Goldin, 1999, p.9).

The Urban Community Enrichment Program (UCEP) sponsored by NASA, originated in 1981 to provide middle school level students in urban areas and under represented communities with an opportunity for involvement of aerospace topics.

It is a component of the Aerospace Education Services Program (AESP) in which specialists collaborate with teachers in implementing an eight-week aerospace program. Core teachers are recommended by school principals and are selected by superintendents. Interdisciplinary specialists that provide an array of hands-on activities that complement the core teachers’ existing curricula conduct the program.

The first workshop is the planning workshop for the eight-week program. The planning workshop is designed to assist in the introduction of the UCEP concept to select educators. It includes a modified assembly lecture demonstration, demonstrations of selected small group activities, and provides information on NASA resources available to teachers, as well as an opportunity to complete the participating school's individual plan. The other two workshops provide teachers with hands-on activities related to NASA's four enterprises. The four enterprises are aeronautics and transportation, human exploration and development of space, space science, and earth science. These emphasize math and science standards (Martel, 1997). A two-week summer enhancement workshop is held as a professional development opportunity for educators’ teaching grades five through eight (Tripp, 1998).

Selected Aerospace Studies

The review of literature includes three dissertations and a research study done by United States Space Foundation that are of importance and relevant to the researcher's study below. They are Marks (1975), Jones (1996), Tripp (1998) and U.S. Space Foundation (1999).

Mark's (1975) study provided information on aerospace curriculum and instruction utilization after the completion of an aerospace education workshop. He identified 373 participants and 234 of those responded. His findings were reported as follows: 51.3 percent did incorporate aerospace concepts in their teachings and 43.2 percent did not. Marks also found that 90 percent of the participants thought that the workshops were useful and beneficial to their teachings, while 6 percent said the workshop was not useful.

Jones (1996) investigated the utilization of aerospace concepts, subject matter, and activities after attending NASA Education Workshop for Elementary School Teachers (NEWEST) workshops. He used a chi-square statistical technique with the level of significance of .05 to determine if there was a relationship between demographic characteristics and the utilization of aerospace concepts, subject matter, and activities presented in the NEWEST workshops. Jones distributed a questionnaire to 75 participants who attend the NEWEST workshop during the years 1993 to 1995. The findings of his study revealed that over 90 percent of the participants used aerospace subject matter and concepts on an average of two or more times per week. In contrast, less than 10 percent did not use the aerospace concepts.

Tripp (1998) studied the impact of NASA's UCEP enhancement workshop on classroom instruction. She used a chi-square technique with the level of significance of .05 to determine the relationship between Categories I, II, and III workshop participant's responses to research questions. Tripp defined Category I as being UCEP teachers who attended only the core workshops and Category II as UCEP teachers who attended only summer enhancement workshops and Category III as UCEP teachers who attended both the core and summer enhancement workshops. Tripp sent a questionnaire to 140 participants who attended UCEP enhancement workshops and core workshops during the years 1994 to 1996. The findings of her study showed that there was not a significant relationship between Category I, II, and III in their response to using the aerospace curriculum materials to introduce new concepts.

The United States Space Foundation (1999) investigated aerospace education as a language proficiency tool for K-12 professional development Spanish program. The Foundation was under the assumptions that there was limited support of resources for bilingual educators in the field. This led to the foundation to investigate exactly what Spanish materials are available for math, science, and technology education. They found that bilingual and English as a Second Language (ESL) materials do exist for non-English speakers. The foundation conducted teacher in-service workshops, while developing both bilingual and monolingual training modules to determine whether teachers needed both training and materials in Spanish, or in standard English accompanied by Spanish materials. Anecdotal feedback, interviews and questionnaires were the source of methodology used in the study.

Summary

This review of literature has presented an overview of bilingual education, multicultural education, teaching science and mathematics effectively to LEP students, reform and reporting challenges that effect limited English speaking students, description of NASA curriculum materials, NASA's involvement in education and the UCEP program, and the review of aerospace studies as it applies to research study.

The literature that still requires investigation is the research of the educators' of LEP students usage of NASA's materials as it applies to concepts, subject matter, and activities in the classroom instruction and curriculum development strategies. Moreover, it is extremely important that NASA recognizes the need of the educators' of LEP students pursuit for instructional materials and curriculum support in efforts to increase science literacy for Limited English Proficiency (LEP) students. The following research questions were designed to examine the usage and implementation of NASA's curriculum materials in support of educators of LEP students..

Research Questions

Specifically, the researcher will seek to gather data to answer the following questions:

1. What are the background characteristics of educators of LEP students who attended UCEP workshops from the 1996-2000 academic years in reference to the following: gender, current teaching level, primary position in the school, number of years teaching, type of school in which they

teach, number of students per class, the dates they were involved in the UCEP workshops and any teacher participation in previous aerospace related workshops?

2. How often were the NASA curriculum materials utilized in the classroom instruction by educators of LEP students?
3. Have the NASA curriculum materials, or the content or skills portrayed in the materials increased educators of LEP students' use of science, mathematics, technologies and geography?
4. What is the user's (educators of LEP students) perception of the quality and utility of the materials as it applies to bilingual instruction and learner characteristics?
5. Of your LEP students how would you rate their ability to fully participate using NASA curriculum related activities?
6. Of the NASA curriculum materials used describe how the materials helped you better facilitate learning to LEP students?
7. How have the NASA curriculum materials been incorporated to LEP students in classroom instruction?
8. What NASA resources were changed to better help facilitate learning for LEP students?
9. How can NASA better serve bilingual education as it applies to instruction, content, and curriculum support?

CHAPTER III

RESEARCH DESIGN AND METHODOLOGY

Introduction

This chapter presents the methodology used to investigate the problem as well as to fulfill the purpose of this study. It includes the statement of the problem, purpose of the study, research questions and a description of the population of educators of limited English proficiency students who participated or used NASA curriculum support materials.

Statement of the Problem

The problem under investigation is to examine to what extent educators of LEP students are utilizing NASA curriculum products in their classroom instruction. More importantly, how are they utilizing the curriculum as it relates to concepts, subject matter, activities in the classroom, and curriculum development strategies.

Purpose of the Study

As described in Chapter I, Hispanic Americans by 2030 will be the largest minority group in the United States according to the U.S. Census. These projections will continue to grow throughout the century. Thus, provisions need to be in place and

curriculum materials need to be at the disposal of educators of LEP students. Therefore, the purpose of the study was to determine how educators of LEP students made use of NASA products and to what extent they utilized the materials as it related to curriculum concepts, incorporation of materials, subject matter, activities, and integration of content through classroom instruction.

Research Questions

As described in Chapter II, the following research questions were designed to determine the utilization of NASA curriculum for students with limited English proficiency:

1. What are the background characteristics of educators of LEP students who attended UCEP workshops from the 1996-2000 academic years in reference to the following: gender, current teaching level, primary position in the school, number of years teaching, type of school in which they teach, number of students per class, the dates they were involved in the UCEP workshops and any teacher participation in previous aerospace related workshops?
2. How often were the NASA curriculum materials utilized in the bilingual classroom instruction?
3. Have the NASA curriculum materials, or the content or skills portrayed in the materials increased educators of LEP students' use of science, mathematics, technologies and geography?

4. What is the user's (educators of LEP students) perception of the quality and utility of the materials as it applies to bilingual instruction and learner characteristics?
5. Of your LEP students how would you rate their ability to fully participate using NASA curriculum related activities?
6. Of the NASA curriculum materials used describe how the materials helped you better facilitate learning to LEP students?
7. How was the NASA curriculum materials been incorporated to LEP students in classroom instruction?
8. What NASA resources were changed to better help facilitate learning for LEP students?
9. How can NASA better serve bilingual education as it applies to instruction, content, and curriculum support?

Population

The population of this study consisted of 180 schools that represented 220 educators responsible for approximately 37,500 students. These educators of LEP students participated in the UCEP program in academic years of 1996 through 2000. This study represents a cross section of urban public school teachers from the California, Arizona, New York, Oklahoma, Connecticut, Delaware, New Jersey, Puerto Rico, and Texas. Methods of selection were based on demographic information obtained by the school districts that were recipients of the UCEP program in the above cities. Schools in those areas that were selected for the UCEP program returned demographic information

that included the population of students and student ethnic background percentages. The data was used to determine which Aerospace Education Specialist would administer the program based on the instructional needs of the schools. The demographic data provided by the schools was used for this study to determine the population of educators that would more than likely have been responsible for the education of LEP students.

Sample

The sample consisted of approximately 64 educators of LEP students. These educators were involved in the UCEP program during the academic years of 1996 through 2000. These years were used because the population of students that the educators were responsible for was equal to or greater than 50 percent Hispanic.

Oklahoma State University was the source for reliable data collected during the 1996 through 2000 academic years. The participants that were selected to attend the UCEP workshops represented the public and urban schools from across the country that met the criteria of selection as outlined below by the UCEP overview brochure and NASA's implementation plan for education:

- Must be a citizen of the United States
- Must be a certified teacher (in grades 5-8)
- Must teach full time in public or private schools in the United States, the U.S. territories, Department of Defense Schools, Department of State overseas schools, or Bureau of Indian Affairs schools.
- No previous participants (however, previous applicants not selected may reapply).

- Workshop strictly for selected participants

The teacher applicants must also summarize their academic and professional experience based on current teaching assignments, formal education, and certification.

Instrumentation

In the study, a NASA Urban Community Enrichment Program survey was the main source of data collection. A survey, also known as a descriptive research is useful for investigating educational problems or issues (Gay, 2000). The survey was used to develop appropriate measurement analysis of the selected variables. The survey instrument was developed to gather data regarding nine research questions (Appendix B). The first questions consisted of demographic information. The remaining items referenced questions on specific information regarding the utilization of NASA curriculum by educators of LEP students. When the survey was constructed, validity of the survey was taken into consideration. In order to validate the survey, the chairman and members of the researcher's doctoral committee, members of the Aerospace Services Program, and Oklahoma State University Institutional Review Board reviewed the survey to determine its content and validity. The first revision of the survey was approved.

Research Design

This study made use of a descriptive research design. The method was appropriate because it allowed data collection via survey and because it is the most commonly used design in collecting data for or about schools (Gay, 2000). School

surveys may examine variables such as community attitudes toward schools, institutional and administrative personnel, curriculum and instruction (Gay, 2000).

This descriptive study attempted to answer questions about the Utilization of NASA Curriculum by Educators of Limited English Proficient Students. The surveys were distributed via regular U.S. mail service no later than November 2001. The survey included: (1) cover letter containing an explanation of the survey and other pertinent information (2) a copy of the survey (3) a return addressed numbered and stamped envelope. 110 reminder postcards were sent approximately three weeks after the surveys were distributed.

Analysis of Data

This study was used to report responses to the Utilization of NASA Curriculum survey. Frequencies and percentages were used to analyze research questions one, two, three, five and six. Qualitative analyses or content analyses that entailed summarizing information from open-ended items on the survey were used for research questions four, seven, eight and nine.

CHAPTER IV

RESULTS OF THE STUDY

In this chapter, the results of the study are examined and reported. The purpose of the study was to determine how and the extent to which educators of LEP students make use of NASA teacher curriculum concepts, subject matter, activities, and content integration in classroom instruction.

A list of addresses for 220 UCEP participants from 1996 to 2000 was obtained from the NASA office at Oklahoma State University, Washington, D.C. office. A survey was sent to each participant. Of the 220 questionnaires sent, 64 questionnaires (29%) were returned, while 21 (13%) were returned by the post office due to the inability to locate the addressees.

Data analyses are presented in two sections and are based on the nine research questions discussed in Chapter II. Part One: *Characteristics of Educators of LEP students /UCEP Participants*, provides quantitative analyses of the responses to research questions one, two, three, five and six are presented in section one. Part Two, *Utilization of NASA Curriculum by Educators of Limited English Proficient Students*, provides qualitative or content analysis of the responses to research questions four, seven, eight and nine. The first section will report data for research questions one, two, three, five and six using frequencies and percentages of educators' of LEP students responses to the

items on the survey that are directly related to each research question. The frequencies and percentages will be concerned with following research questions:

- 1 - Background characteristics of the educators of LEP students / UCEP participants;
- 2 - Frequency of the utilization of NASA curriculum products in bilingual classroom instruction;
- 3 - Incorporation of increased use in science, mathematics, technologies and geography;
- 5 - The ability to fully participate using NASA curriculum related activities;
- 6 - A description of how the materials helped facilitate learning;

The second section will use qualitative analyses or content analyses that will be used to answer research questions four, seven, eight and nine found in Chapter II. It is used to determine the presences of a recurring themes within the educators' responses concerning:

- 4 - The educators' of LEP students perception of the NASA curriculum as it applies to bilingual instruction;
- 7 - Curriculum materials incorporated to meet needs of LEP students in the classroom;
- 8 - The changing of NASA resources to better facilitate non-English speakers;
- 9 - The improvement of NASA curriculum as it applies to support;

Responses to the Survey

In response to the survey study, Part One will analyze the responses of the teachers' demographic and characteristic using frequencies and percentages as the form of data. Part two will report content analysis through summarization of teachers responses and feedback.

Part One – Characteristics of Educators of Limited Proficient

Students/UCEP Participants

Research Question One – *What are the background characteristics of educators of LEP students that attended UCEP workshops from the 1996-2000 academic year in reference to the following: gender, current teaching level, primary position in the school, number of years teaching, type of school in which they teach, number of students per class, the dates they were involved in the UCEP workshops and any teacher participation in previous aerospace related workshops?*

Survey items 1-10 address this overall research question. Supporting data for this research question are presented in Table I, survey items 1-10 (see Appendix B) for a copy of the survey. Findings show of 64 participants responding, 12 (18.8%) of the teachers were male, while 52 (81.2%) were female. The largest group of teachers (79.7%) taught grades 5-8, the next largest group (10.9%) taught grades 9-12. Close to eight percent (7.8%) of the teachers taught K-4. One teacher (1.6%) did not respond.

TABLE I
WORKSHOP PARTICIPANTS' DEMOGRAPHIC
CHARACTERISTICS

Demographic Characteristics	Frequency	Percent
<u>Gender</u>		
Male	12	18.8
Female	<u>52</u>	<u>81.2</u>
Total	64	100.0
<u>Current Teaching Level</u>		
K-4	5	7.8
5-8	51	79.7
9-12	7	10.9
No response	<u>1</u>	<u>1.6</u>
Total	64	100.0
<u>Primary School Position</u>		
Teacher	58	90.6
Administrator	3	4.7
Counselor	1	1.6
Librarian	1	1.6
No response	<u>1</u>	<u>1.6</u>
Total	64	100.0
<u>Years Teaching Experience</u>		
1-5	7	10.9
6-10	13	20.3
11-15	10	15.6
16-20	11	17.2
21-25	11	17.2
Over 25	<u>12</u>	<u>18.8</u>
Total	64	100.0
<u>Highest College Degree</u>		
Bachelor	25	39.1
Master	37	57.8
Doctorate	<u>2</u>	<u>3.1</u>
Total	64	100.0
<u>Type of School Taught</u>		
Public	57	89.0
Private	4	6.2
Magnet	1	1.6
Military	0	0
Charter	0	0
Urban Suburban	0	0
Rural	1	1.6
No response	<u>1</u>	<u>1.6</u>
Total	64	100.0

TABLE I (Continued)

Demographic Characteristics	Frequency	Percent
<u>Demographic Population of School</u>		
African American	12	18.7
White	2	3.1
Hispanic	35	54.7
Asian or Pacific Islander	1	1.6
American Indian	3	4.7
Other	<u>11</u>	<u>17.2</u>
Total	64	100.0
<u>Number of Students in Classroom</u>		
1-15	4	6.2
16-20	5	7.8
21-25	19	29.7
26-30	27	42.2
31-35	9	14.1
More than 35	<u>35</u>	<u>0</u>
Total	64	100.0
<u>Classroom Staff</u>		
Myself	52	81.3
Myself and one other person	7	10.9
Myself and two other person	3	4.7
Myself and three other people	2	3.1
Myself and more than three other people	<u>0</u>	<u>0</u>
Total	64	100.0
<u>Number of Aerospace Workshops Attended</u>		
None	5	7.8
One	17	26.6
Two	15	23.4
Three	12	18.8
Four	6	9.4
More than four	<u>9</u>	<u>14.0</u>
Total	64	100.0

Regarding their primary positions, 58 (90.6%) identified themselves as teachers; three (4.7%) as administrators, and each (1.6%) as a counselor or librarian. One participant did not respond (1.6%). When asked about their years of teaching experience, seven (10.9%) had taught 1-5 years, 13 (20.3 %) taught 6-10 years, 10 (15.6 %) taught 11-15 years, 11

(17.2%) taught 16-20 years, 11 (17.2%) taught 21-25 years and 12 (18.8%) taught 25 years or more. When asked about the highest college degree held by participants, a majority of 37 (57.8%) obtained a Masters degree, 25 (39.1%) obtained a Bachelor degree and two (3.1%) held a doctorate. Participants came from various types of schools. The majority of 57 (89.0%) came from urban public schools, four (6.2%) private schools, one (1.6%) magnet schools, one (1.6%) rural public schools and one (1.6%) reported as no response.

The demographic populations of the schools were collected showing a majority 35 (54.7%) were Hispanic, followed by 12 (18.7%) African Americans, three (4.7%) American Indians, two (3.1%) White, and one (1.6%) Asian, while others 11 (17.2%) represented a racial mix of ethnic groups.

In relation to the average number of students per class, four (6.2%) had 1-15 students in the classroom, five (7.8%) had 16-20 students in the classroom, 19 (29.7%) had 21-25 students in the classroom, 27 (42.2%) had 26-30 students in the classroom, and nine (14.1%) had 31-35 students in the classroom.

Findings showed that most of the teachers 52 (81.3%) were in the classroom setting alone. There were seven (10.9 %) of the teachers who worked in the classroom with one other person. There were three (4.7%) of the teachers who worked in the classroom with more than two persons. There were two (3.1%) of the teachers who worked in the classroom with more than three persons.

Prior to attending UCEP workshops, five (7.8%) had never attended an aerospace workshop. On the other hand, nine (14.0%) had attended five or more workshops. The remaining percentages that had attended one, two, three, or four workshops were 17

(26.6%), 15 (23.4%), 12 (18.8%), and six (9.4%), respectively. See Table I for a listing of these results.

The Utilization of NASA Curriculum

Research Question Number Two – *How often were the NASA curriculum materials utilized in the classroom instruction by educators of LEP students?*

In examining the utilization of NASA curriculum materials in bilingual classroom instruction, survey item number eleven was used (Appendix B). Survey question number eleven is represented in Table II.

TABLE II
THE UTILIZATION OF NASA CURRICULUM PRODUCTS

Utilization of Materials	Frequency	Percent
I have not used them	7	10.9
1-3 lessons a year	18	28.1
4-6 lessons a year	12	18.8
7-10 lessons a year	16	25.0
More than 10 lessons a year	<u>11</u>	<u>17.2</u>
Total	64	100.0

Information presented in Table II shows the utilization of materials and shows that 7 (10.9%) of participants did not utilize materials in the bilingual instruction. In contrast, approximately, 18 (28.1%) used curriculum materials in 1 to 3 lessons a year, 12 (18.8%) used the materials for 4-6 lessons a year, 16 (25.0%) used 7-10 lessons a year and lastly, 11 (17.2%) of teachers used more than 10 lessons a year.

The Incorporation of NASA Curriculum Materials

Research Question Number Three – *Have the NASA curriculum materials, or the content or skills portrayed in the materials increased educators' of Limited Proficient Students use of science, mathematics, technologies and geography?*

To provide an answer for this question, data from survey items twelve and thirteen were used (Appendix B). Information presented in Table III gives the frequency and percentages of the incorporation of NASA curriculum materials by the educators and whether or not the curriculum met the needs of the instruction.

Information presented in Table III represents how often the NASA curriculum materials were incorporated into classroom instruction. Information presented showed 35 (54.7%) of teachers did not respond to the question. According to the information presented in Table III, 16 (25%) incorporated NASA curriculum materials 1-3 lessons a year and seven (10.9%) incorporated curriculum materials 4-6 lessons a year and two (3.1%) incorporated curriculum materials 7 -10 lessons a year leaving four (6.3%)

incorporating materials more than 10 lessons a year. See Table III for listing of these results.

TABLE III
INCORPORATION OF NASA CURRICULUM MATERIALS

Curriculum Incorporation	Frequency	Percent
No Response	35	54.7
1-3 lessons a year	16	25.0
4-6 lessons a year	7	10.9
7-10 lessons a year	2	3.1
More than 10 lessons a year	<u>4</u>	<u>6.3</u>
Total	64	100.0

Table IV provides information showing whether or not the materials, or the content or skills met the needs of the educators of LEP instruction. 11 (17.2%) of the educators responded no the materials did not meet their needs and 32 (50%) responded yes that the NASA curriculum materials, or content or skills met the needs of the instruction. Additionally 21 (32.8%) of the educators did not respond to this survey question.

The educators were given the opportunity to write additional comments regarding whether or not the instructional needs were met. The following comments were given:

- They have to be translated
- It meets the needs, but needs to be further simplified for LEP students
- Material needs to be translated
- Curriculum can be adapted to the needs of LEP
- Bilingual material are limited if none
- Materials are hard to understand by our limited English speakers
- Most needs were met, a few do not speak English well and their teacher translated information to them
- It does, but it needs to be further simplify in the other language so that can at least understand what the activity is asking of them
- Because direction would need to be in Spanish for the explanation of the materials
- Our school does not have an adequate number of educators for the number of students. Classes are over crowded. Time is given mainly towards state testing.
- Have never seen any bilingual materials
- I have to translate the materials
- Vocabulary is complicated, higher order thinking as well.
- It's easier if the teacher has the information in Spanish as well to make connections to English version
- We can apply new experiences with the new materials we have, sometimes it is really hard to translate materials into Spanish. We need to make it available to those that need it

- Most of the activities are hands-on and require students in cooperative groups which helps bilingual students

A summary of the previous feedback reveal that 32 (50%) of the educators of LEP students agreed that NASA curriculum products met their instructional needs. However, though a majority of the teachers agreed that the curriculum products met their needs, materials were often translated to better accommodate their LEP students during instructional delivery. In addition, 11 (17%) of the teachers stated that the curriculum products did not meet their needs. Also, the feedback often revealed an expressed need to have the materials in both languages because this would help students gain a better understanding of scientific concepts and vocabulary. Unfortunately, 21 (32.8%) of the teachers did not respond to the question. See Table IV for a listing of these results.

TABLE IV

NASA CURRICULUM MATERIALS MEETING NEEDS

Materials, content or skills meeting the needs	Frequency	Percent
No	11	17.2
Yes	32	50.0
No Response	<u>21</u>	<u>32.8</u>
Total	64	100.0

Appealing and Interesting To Students

Research Question Number Five – *Of your LEP students how would you rate their ability to fully participate using NASA curriculum related activities?*

To provide information for this question, data from the survey item fifteen were used (Appendix B). Information presented in Table V gives the frequency and percentages based on the appeal and interest of the topics that were taught by educators of LEP students. Approximately, three (4.7%) said the activities were excellent, 14 (21.9%) said the activities were very good, 13 (20.3%) said the activities were good, seven (10.9%) said the activities were fair, two (3.1%) said the activities were poor and unfortunately, 29 (39.1%) did not respond to the survey question.

TABLE V
APPEALING AND INTERESTING TOPICS

Appealing or Interested	Frequency	Percent
Excellent	3	4.7
Very Good	14	21.9
Good	13	20.3
Fair	7	10.9
Poor	2	3.1
No Response	<u>29</u>	<u>39.1</u>
Total	64	100.0

How Workshop Materials Helped Better

Facilitate to LEP Students

Research Question Number Six – *Of the NASA curriculum materials used describe how the materials helped you better facilitate learning to LEP students?*

In analyzing research question number six on how the materials helped better facilitate learning to LEP students, survey question number sixteen was used (Appendix B). In order to analyze the data from survey question number sixteen two categories were established. Language and hands-on learning were the categories selected in reporting how materials helped to better facilitate learning to LEP students. The data in Table VI reported 17 (26.6%) of the participants did not respond to this question, 20 (31.2%) reported that materials should be translated into Spanish and 27 (42.2%) reported that the hands-on approach would benefit limited English proficiency speakers. A brief summary of the teachers comments in regards to the categories is shared in the conclusion of these finding. Examples of the collected responses are shown below:

- Hands on activities are a good way to get concepts across despite language barriers
- Through follow up workshops, Spanish resources, team teaching
- Students learn best when they can understand what they read or see
- Making NASA materials bilingual would influence LEP students to want to learn science

- Materials need to be written in Spanish so that students can get a clear understanding
- The hands-on materials facilitate LEP students' understanding by doing than reading
- They should know both concepts in both English and Spanish
- The hands-on approach is very conducive to LEP learners
- Materials should be distributed in the language of the target audience with respect to both languages
- Material should be appropriate to the student's proficiency level
- Through the use of hands-on LEP students benefit greatly, thus providing them with real life examples of how the world works

TABLE VI
HOW MATERIALS HELPED FACILITATE

Categories	Frequency	Percent
No Response	17	26.6
Language	20	31.2
Hands-on Training	<u>27</u>	<u>42.2</u>
Total	64	100.0

The overall responses were in support of the NASA curriculum activities that promoted hands-on learning. Teachers felt that this method allowed students to see and feel the meanings of words instead of just hearing the definitions. However, teachers were dissatisfied with the lack of curriculum materials for limited English-speaking students who have linguistic challenges.

Part Two – Utilization of NASA Curriculum by Educators of Limited Proficient Students

Perception of Curriculum Materials

Research Question Number Four – *What is the user's (educators of LEP students) perception of the quality and utility of the materials as it applies to bilingual instruction and learner characteristics?*

In analyzing question number four on the user's perception of the quality and utility of the materials, survey question number fourteen was used (Appendix B). In order to analyze the data from survey question number fourteen, three categories were established. Positive, negative and neutral categories are used in reporting the perceptions of the educators of the LEP students. Data reported that 14 (21.9%) were positive, six (9.4%) were negative, and five (7.8%) were neutral and unfortunately, 39 (60.9%) didn't respond to the survey question. The following examples were given:

- Quality is good just needs to be in Spanish as well

- Materials provide innovating alternatives that enrich our science curriculum. It would be very difficult to translate every activity to be used in the bilingual classroom
- Materials work well, unless new arrivals of non-English speakers arrive
- Materials are great, but additional support in translated materials would ease the burden on non-English students in transitional periods
- Difficult to use some of the resource materials, the human body lesson is an example. Additional worksheets in different languages are encouraged
- The material is appropriate for advanced learners, but bilingual students struggle to comprehend material needed to pass basic curriculum. They don't have the help at home or financial resources to purchase necessary materials and supplies needed for these activities
- The quality is poor because it does not take into account the learners' primary language or the learner's limited English skills
- I would prefer to have the materials in Spanish. Although I can use them in class and my students enjoy them very much. Many would like to be able to read them in Spanish

Feedback from the teachers revealed that 21% had favorable responses on their perception of the quality and the utility of the materials. Teachers made comments in relation to materials complementing their curriculum and being very useful. In addition, 9.4% of the teachers gave negative responses referencing the lack of appropriate materials for LEP students. A summary of the neutral comments revealed that the curriculum materials may be more useful. Overall, the teachers utilized the NASA's curriculum

products, but emphasized that translating materials can be time consuming and often interrupts vital instructional and preparation time. See Table VII for a listing of the results.

TABLE VII
PERCEPTIONS OF THE EDUCATORS OF LIMITED
PROFICIENT STUDENTS

Responses	Frequency	Percent
Positive	14	21.9
Negative	6	9.4
Neutral	5	7.8
No Response	<u>39</u>	<u>60.9</u>
Total	64	100.0

Incorporation of NASA Curriculum to LEP Students

Research Question Number Seven – *How were the NASA curriculum materials incorporated to Limited Speaking Proficiency students in classroom instruction?*

In analyzing question number seven, survey question number seventeen was used (Appendix B). A theme was created based on the collective responses from survey participants.

Theme: The usage and incorporation of NASA Curriculum by LEP students for classroom instruction

Teachers' responses varied to survey question number seventeen. The data collected was in direct response to the research question on how NASA materials were incorporated to better facilitate learning to LEP students. In response to the question, a number of responses were strongly in favor of the overall development of activities that were more hands-on in dealing with LEP students. However, teachers made it clear that despite the many challenges they face with language barriers, LEP students tend to have a higher rate of success when engaged in the hands-on approach. Some methods of incorporation are listed below:

- The importance of incorporating vocabulary development into science lessons to both ensure that students understand the science and to improve their English skills.
- Incorporating language into science activities. These activities could include writing summaries, drawing pictures and reporting out using oral or written reports.
- Corporative group activities
- Inquiry/Discovery based instruction
- Integrating Science and Mathematics

Teachers were pleased with the overall activities and subject matter that can be utilized cross-curriculum with regard to the language barriers they face in their school.

Improving NASA Curriculum Materials

Research Question Number Eight – *What NASA resources were changed to better help facilitate learning for LEP students ?*

In analyzing research question number eight, survey question number eighteen was used (Appendix B). In order to analyze the data from survey question eighteen a summary of the responses was collected in response to the survey question. A theme was created based on the collective responses from survey teachers.

Theme: Adapted resources using NASA curriculum materials to meet the needs of the non-English speaking learners

In response to survey question number eighteen; “How were the materials used or changed to meet the needs of a non-English speaking learner?” Teachers shared a number of innovating strategies, techniques and ideas on how they utilized the NASA curriculum to meet the needs of the LEP student during science lessons. Teachers used team teaching effectively, as a means to get students involved helping one another when confronted with a challenging vocabulary or activities. Cooperative learning techniques are an effective way to teach science to LEP students. It fosters language development through the verbal and written communication among students themselves. Activities were generally modified to meet the language barriers found in most LEP classrooms. The following examples were given:

- Counselors were involved in the translation of materials
- Teachers used dictionaries to translate English to Spanish
- Cooperative activities
- Vocabulary and written communication were simplified for the purpose of understanding the concepts
- Teachers utilized team teaching, by pairing students together who spoke both fluent English and Spanish

A majority of the responses focused around translation of materials and modifying NASA's curriculum to meet the needs of the LEP student. The importance for NASA to develop curriculum that supports the non-English learners and bilingual community would be a giant leap for non-English speakers, in their quest to be the next generation of scientists, mathematicians, and technicians in the future. Spanish adapted materials will enable non-English speaking students to obtain a good foundation and understanding of space science.

Developing Instructional Curriculum to Enhance

Bilingual Education

Research Question Number Nine – *How can NASA better serve bilingual education as it applies to instruction, content, and curriculum support?*

In examining research question number nine, survey question number nineteen was used (Appendix B). The responses to the survey were collected, analyzed and

summarized. In addition, a theme was created based on the collective responses from the survey teachers.

Theme: Developing NASA curriculum with bilingual education in mind

The majority of the responses from survey question nineteen constantly elaborated on the importance of developing curriculum with the LEP student in mind. Teachers were in support of having materials written in Spanish and supporting educators of limited proficient students to be involved in the curriculum process when designing materials for LEP students. Teachers recommended that when implementing science curriculum for culturally diverse groups of the students and teachers, the agency should to take into account the linguistic challenges and lack of training educators of LEP students face in the science community. Teachers as a result of survey question nineteen made the following comments:

- Selected enhancement guides should be translated
- Curriculum should be made with the LEP student in mind.
- Simplify materials, have more illustration
- Institute a follow-up program to address any challenges participants may be having in the field
- Develop and implement training specifically for educators of LEP students
- Develop curriculum for the linguistically challenged
- Provide professional development opportunities to educators of LEP students

However, teachers were overall pleased with the NASA curriculum, but recommended that NASA have translated materials available that reflect the Limited English Speaking communities involved.

CHAPTER V

SUMMARY, FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

Summary

The purpose of this study is to determine how and the extent to which educators of LEP students make use of NASA teacher curriculum concepts, subject matter, activities, and content integration in classroom instruction.

Data for this study were gathered from the Urban Community Enrichment Program survey sent to 220 participants who were involved with the UCEP between 1996 and 2000. These educators represented educators from bilingual urban schools from the United States and the Commonwealth of Puerto Rico.

Data were obtained from a survey mailed to each participant. The survey was devised to collect demographic information, determine the utilization of NASA curriculum instruction, and resources, and integration of aerospace concepts by educators of LEP students.

The approved survey was comprised of 19 questions. It was mailed to each teacher, accompanied by a cover letter and return stamped envelope. The first ten items gathered data about the demographic characteristics of the educators. Items eleven through nineteen collected specific information regarding how the educators utilized

materials. Surveys were mailed on April 2, 2001, to 220 educators of LEP students with 64 (29.1%) educators returning the completed survey.

Upon receipt of the completed survey, data were processed mathematically by hand. Frequency counts were tabulated for each question and percentages were computed for the total returned population. The following research questions were discussed:

1. What are the background characteristics of the educators of LEP students who attended UCEP workshops from the 1996-2000 academic years in reference to the following: gender, current teaching level, primary position in the school, number of years teaching, type of school in which they teach, number of students per class, the dates they were involved in the UCEP workshops and any teacher participation in previous aerospace related workshops?
2. How often were the NASA curriculum materials utilized in the classroom instruction by educators of LEP students?
3. Have the NASA curriculum materials, or the content or skills portrayed in the materials increased educators of LEP students' use of science, mathematics, technologies and geography?
4. What is the user's (educators of LEP students) perception of the quality and utility of the materials as it applies to bilingual instruction and learner characteristics?
5. Of your LEP students how would you rate their ability to fully participate using NASA curriculum related activities?

6. Of the NASA curriculum materials used describe how the materials helped you better facilitate learning to LEP students?
7. How have the NASA curriculum materials been incorporated to LEP students in classroom instruction?
8. What NASA resources were changed to better help facilitate learning for LEP students ?
9. How can NASA better serve bilingual education as it applies to instruction, content, and curriculum support?

Findings

The subsequent findings support that specialized instruction and translated NASA materials would give educators of LEP students significant resources for their students and instructional support. “Educators who utilize intercultural competence and collect information on available culturally and linguistically appropriate materials...are more likely to be successful in their work . . . than educators or teachers who do not do so” (Garcia, 1995). According to the review of literature, research has concluded that:

- Cultural differences can influence how teachers view the behaviors of students in classroom.
- A combined curriculum teaching science using methods that are more understandable and meaningful to multicultural students increases English language proficiency.
- Children learn a second language by using the semantics of their native language as a foundation.

- Instruction of mathematics that emphasizes and incorporates language activities in curricula can benefit LEP students by helping them relate cultural and linguistic ideas to the application of mathematical problems.
- Curriculum should be developed with the language and cultural make up of the community being served, while including educators of various cultures in the designing and training processes.

The surveyed educators continuously expressed their interest in NASA producing curriculum materials that support non-English learners. Unfortunately, NASA has limited resources to support bilingual education in its entirety. Maria Schwarz, head of the NASA Educational Resource Center at the University Mayaguez , Mayaguez, Puerto Rico whose educators are responsible for limited English speaking students stated “I’ve translated NASA materials and activities in the past and on numerous accounts I have been asked; Why has not NASA produced materials translated into Spanish?” According to Schwarz, NASA responded that “there were limited funds available for translations and their were major difficulties in translating different dialects of Spanish which differ from culture to culture” (Schwarz, M. personal interview, February 19, 2000). However, if materials are translated the instruction is more meaningful and relevant to the LEP students of diverse linguistic communities. Based on the data presented in Chapter IV, the findings of the study are as follows:

- 81.2% of the educators of LEP students were female.
- 79.7% of the teachers taught grades five through eight.
- 9.6% were actual teachers.
- 57.8% of the teachers had a master’s degree.

- 89.0% of the teachers taught in public schools.
- The greatest number of teachers taught in schools where the student demographic population was Hispanic. 54.7%.
- 81.3% of the teachers taught alone in a classroom setting.
- 26.6% of the teachers attended at least one aerospace workshop.
- 28.1% of the teachers after attending the UCEP workshops used curriculum products in the classroom from 1- 3 lessons a year.
- 25% incorporated the NASA curriculum material in bilingual classroom instruction 1-3 lessons a year.
- 50% of the teachers reported that the materials, content or skills met the needs of the bilingual instruction.
- The majority of the teachers had a positive perception of the quality and utilization of materials as it applies to bilingual instruction.
- 21.9% of the teachers stated the activities were very good at being appealing and interesting to students.
- 42.2% of the teachers reported that the hands-on approach would benefit limited English proficiency speakers.
- The central theme surrounding the usage and incorporation of NASA curricula by LEP students for classroom instruction revealed a strong favor of the overall development activities that were more hands-on.
- Innovative approaches using NASA curriculum materials were reported as:
 - Utilizing team-teaching
 - Cooperative activities

- Paring students together
- Utilization of bilingual counselors as translators
- Developing Instructional Curriculum to Enhance Bilingual Education were reported as:
 - Curriculum should be made with the LEP student in mind
 - Selected enhancement guides should be translated
 - Simplify materials
- Institute a follow-up program or materials to address any challenges participants or students face in the sciences.
- Develop and implement training specifically for educators of LEP students.
- Provide professional development opportunities to educators of LEP students.
- Utilization of hands-on materials as a means to facilitate classroom instruction for LEP students.
- Develop a host of posters, lithographs and activities that represent the ethnicity of the groups involved.

Conclusions

The following conclusions were reached from the findings of this study:

- The findings indicate that UCEP participants are utilizing curriculum materials after attending a NASA workshop.
- A majority of the educators were in agreement that the materials, content or skills were beneficial to LEP students.

- Judging from the positive responses, educators had a positive perception of the quality and utilization of materials as it applies to bilingual instruction.
- UCEP participants are demonstrating innovating approaches through team teaching, integrating curriculum, peer tutoring and translating materials as needed.
- A majority of the teachers utilized and incorporated NASA materials as a means to reach LEP students, through the overall development of hands-on activities and cross curriculum subjects.
- Instructional curriculum should be developed specifically with the LEP students mind.
- Teachers agreed that materials should reflect the culture and background of those involved.
- The findings indicated that the need for developing and designing curriculum materials for educators of LEP students is moving in the right direction.
- NASA participants express the need to implement professional development courses for educators of LEP students who teach the sciences and mathematics.
- Overall the need to develop bilingual materials is embraced by the educators of LEP students involved in the study.

As a result of the study, it is strongly recommended that NASA develop training materials in the area of second language acquisition to educators of students who are linguistically challenged. Therefore, providing limited English-speaking students the

proper materials and pedagogical instruction to develop solid English language ability, critical thinking, scientific and mathematical skills to compete in today's society. The future of bilingual education will always be in the forefront of educational reform in America's schools and will extent globally. Through the use Spanish adapted materials educators of NASA's Urban Community Enrichment Program would gain additional reinforcement to assist teachers and students who face linguistic challenges to fully participate in the science community.

In my opinion, while the most obvious communication challenge is the language barrier, there are also major cultural differences that must be addressed in order for NASA to produce culturally relevant and linguistically correct materials. At present developing documents for Hispanics/Latinos has often meant directly translating English documents into Spanish, which has incorrectly assumed a certain level of acculturation, and has not always preserved the intended meaning. It is my intention from this study to encourage NASA to recognize the value and importance of educators of limited English proficiency students as they play a significant role in America's future. Through the use aerospace topics students of all races and cultures can learn the importance of:

- goal setting
- self-discipline
- perseverance in achieving their hopes and dreams

Lastly, my five-year tenure with the NASA Urban Community Enrichment Program exposed me to the disadvantages that educators of LEP students face. I have had the opportunity to walk through the hallways of urban public schools across the U.S. and have witnessed the effects of reform efforts such as Proposition 227 passed in California.

Being amidst the dismantling of bilingual educational programs gave me inspiration to conduct research on how NASA program materials could play a pivotal role in encouraging educators of LEP students to use science, mathematics and technology as a vehicle toward the academic success of minorities.

Recommendations

The findings and conclusions of this study lead to the following recommendations by the author:

1. UCEP workshop continues to be supported by NASA as a means to reach under represented science and mathematic communities.
2. UCEP/NASA should be more involved with minority organizations that support education, civic, professional conferences and reform efforts for systemic change.
3. The need to develop instructional material for the LEP students is recommended and supported by participants in the study.
4. Preschool science curriculum that includes English instruction to help LEP students overcome obstacles and challenges they face in school.
5. Effective instructional strategies for LEP students and educators of LEP students alike.
6. Further, integration of science, mathematics, and English at the elementary and middle school levels.
7. Develop teacher in-service workshops for educators of limited English speaking students (Bilingual education. English as a Second Language) on

the usage and development Spanish resource materials using aerospace topics.

Recommendations for Future Research

1. Provide a means for participants to collaborate and share learning experience through the use of the Internet, owned and operated by UCEP staff.
2. Conduct a study to see to what extent the LEP students' attitudes toward science and mathematics have after educators of LEP students attend UCEP teacher enhancement workshops.
3. Further determine the degree to which UCEP educators of LEP students integrate the aerospace education concepts, instruction, and hands-on activities as a means to provide needed follow-up and feedback to LEP students.
4. Future research should study the way UCEP workshops could be enhanced and improved to reach the educators of LEP students to better serve LEP students.
5. Develop an assessment process in evaluating instructional delivery of UCEP educators of LEP students.

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APPENDIXES

APPENDIX A

SURVEY COVER LETTER

March 25, 2001

Dear Former UCEP Participants:

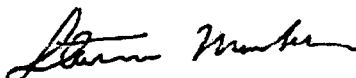
For the past nineteen years, Oklahoma State University / UCEP has provided extensive professional development opportunities to school systems around country. To continue our goal for educational excellence, your participation is requested in a study to aid us in better understanding the instructional need for bilingual educators. Your response to the survey will assist us in developing specific instructional curriculum materials to meet the needs of teachers and students.

As a former UCEP participant, you are asked to fill out the enclosed survey to the best of your knowledge. After you have completed the survey, please return the survey immediately in the self-addressed stamped envelope. Your prompt response is critical in processing the survey and will allow instructional provisions to be made to better serve our participants.

If for any reason we do not received your response within three weeks, a reminder postcard will be sent for follow-up purposes only. The surveys will be removed from the envelopes and placed in a closed box. All of the envelopes will be destroyed before the survey responses are read. Therefore, anonymity is assured.

Thank you for your assistance in this study. Your cooperation is greatly appreciated.

Sincerely,



Steve Marks
Director

APPENDIX B

SURVEY INSTRUMENT

Oklahoma State University
Center for Aviation and Space Education

NASA Urban Community Enrichment Program (UCEP) Workshop

To aid in improving the NASA UCEP curriculum support materials, please respond to all of the statements or questions to the best of your knowledge. Some questions require that you circle the corresponding letter, while other questions offer you the opportunity to provide examples of your unique experience. Your participation will have an effect on the future publication of the NASA curriculum enhancement materials and teacher workshops. Please [DO NOT] include your name. Thank you for your assistance with this survey. Vocabulary Key: Limited English Proficiency (LEP)

1. My gender is:

- A. Male
- B. Female

2. The grade(s) I currently teach are:

- A. K-4
- B. 5-8
- C. 9-12

3. My primary position in the school is:

- A. Teacher
- B. Administrator
- C. Counselor
- D. Librarian
- E. Other _____

4. My number of years of teaching experience is:

- A. 1-5
- B. 6-10
- C. 11-15
- D. 16-20
- E. 21-25
- F. Over 25 years

5. My highest college degree attained is:

- A. Bachelor's
 - B. Master's
 - C. Doctorate
6. The type of school in which I teach is (circle all that apply):
- A. Public
 - B. Private
 - C. Magnet
 - D. Military
 - E. Charter
 - F. Urban
 - G. Suburban
 - H. Rural
7. The demographic population of my school is:
- A. African American
 - B. White
 - C. Hispanic
 - D. Asian or Pacific Islander
 - E. American Indian
 - F. Other _____
8. The average number of students in my classes is:
- A. 1-15
 - B. 16-20
 - C. 21-25
 - D. 26-30
 - E. 31-35
 - F. More than 35
9. The educational staffing (e.g. teacher, teacher's aid) of my classroom is:
- A. Myself
 - B. Myself and one other person
 - C. Myself and two other people
 - D. Myself and three other people
 - E. Myself and more than three other people
10. The number of aerospace workshops attended including NASA UCEP were:

- A. None
 - B. One
 - C. Two
 - D. Three
 - E. Four
 - F. Four or more
11. I have used the curriculum materials provided in the NASA UCEP workshop to enhance my subject curriculum:
- A. I have not used them
 - B. 1-3 lessons a year
 - C. 4-6 lessons a year
 - D. 7-10 lessons a year
 - E. More than 10 lesson a year
12. How often were the NASA curriculum materials incorporated in the bilingual instruction:
- A. None
 - B. 1-3 lessons a year
 - C. 4-6 lessons a year
 - D. 7-10 lessons a year
 - E. More than 10 lessons a year
13. Does the NASA curriculum materials, or the content, or skills meet the needs of the bilingual instruction:
- A. No
 - B. Yes
- If no, please explain briefly:
-
-

14. What is the user's (teacher) perception of the quality and utility of the materials as it applies to bilingual instruction and learner characteristics:

Please explain:

15. Of your LEP students, how would you rate their general ability to fully understand the NASA curriculum related activities as applies to science, mathematics, technology and geography:

- A. Excellent
- B. Very Good
- C. Good
- D. Fair
- E. Poor

16. How would the NASA curriculum used help you better facilitate learning to LEP students:

Please explain:

17. Give an example of how you incorporated NASA's curriculum activities to LEP students:

Please explain:

18. How were the materials used or changed to meet the needs of a non-English speaking learner:

Please explain:

19. How can NASA better serve bilingual education as it applies to instruction, content, and curriculum support:

Please explain:

APPENDIX C
RESEARCH QUESTIONS

The researcher will seek to gather data to answer the following questions:

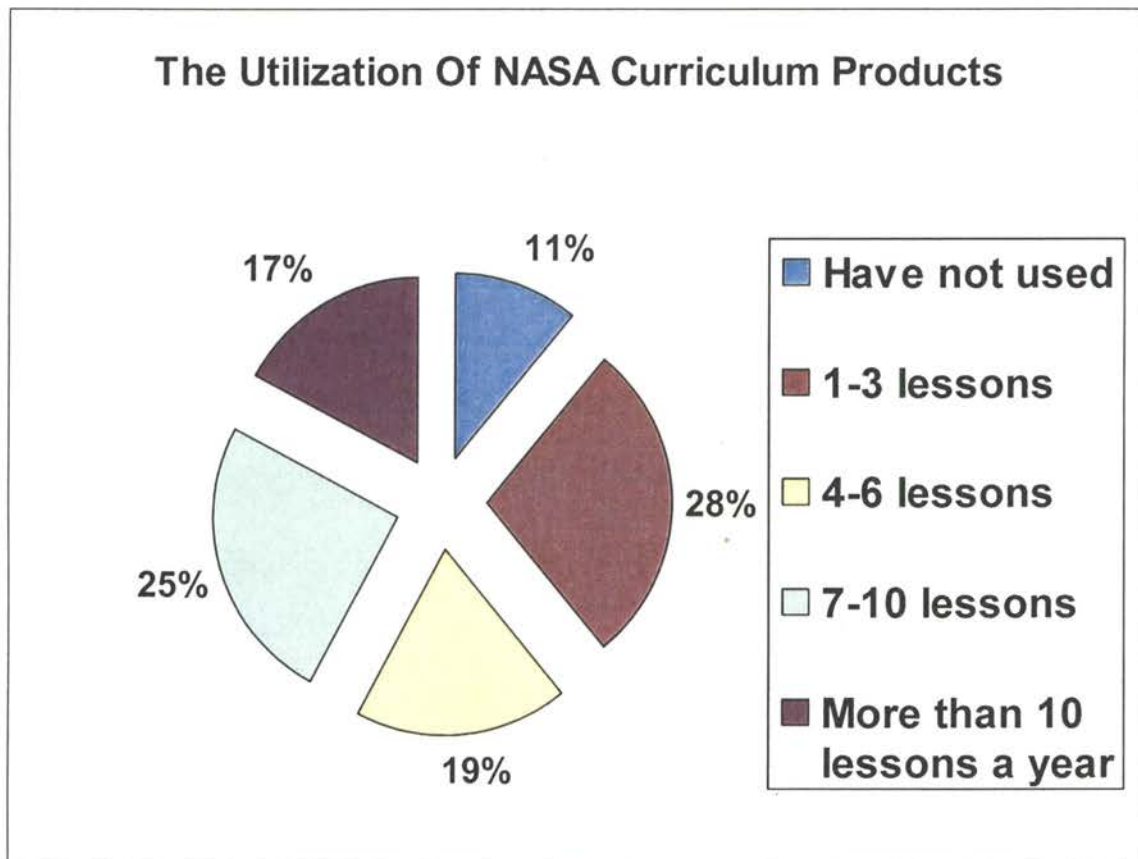
1. What are the background characteristics of educators of LEP students who attended UCEP workshops from the 1996-2000 academic year in reference to the following: gender, current teaching level, primary position in the school, number of years teaching, type of school in which they teach, number of students per class, the dates they were involved in the UCEP workshops and any teacher participation in previous aerospace related workshops?
2. How often were the NASA curriculum materials utilized in the bilingual classroom instruction?
3. Have the NASA curriculum materials, or the content or skills portrayed in the materials increased educators of LEP students' use of science, mathematics, technologies and geography?
4. What is the user's (educators of LEP students) perception of the quality and utility of the materials as it applies to bilingual instruction and learner characteristics?
5. Of your LEP students how would you rate their ability to fully participate using NASA curriculum related activities?
6. Of the NASA curriculum materials used describe how the materials helped you better facilitate learning to LEP students?
7. How was the NASA curriculum materials been incorporated to LEP students in classroom instruction?

8. What NASA resources were changed to better help facilitate learning for LEP students?
9. How can NASA better serve bilingual education as it applies to instruction, content, and curriculum support?

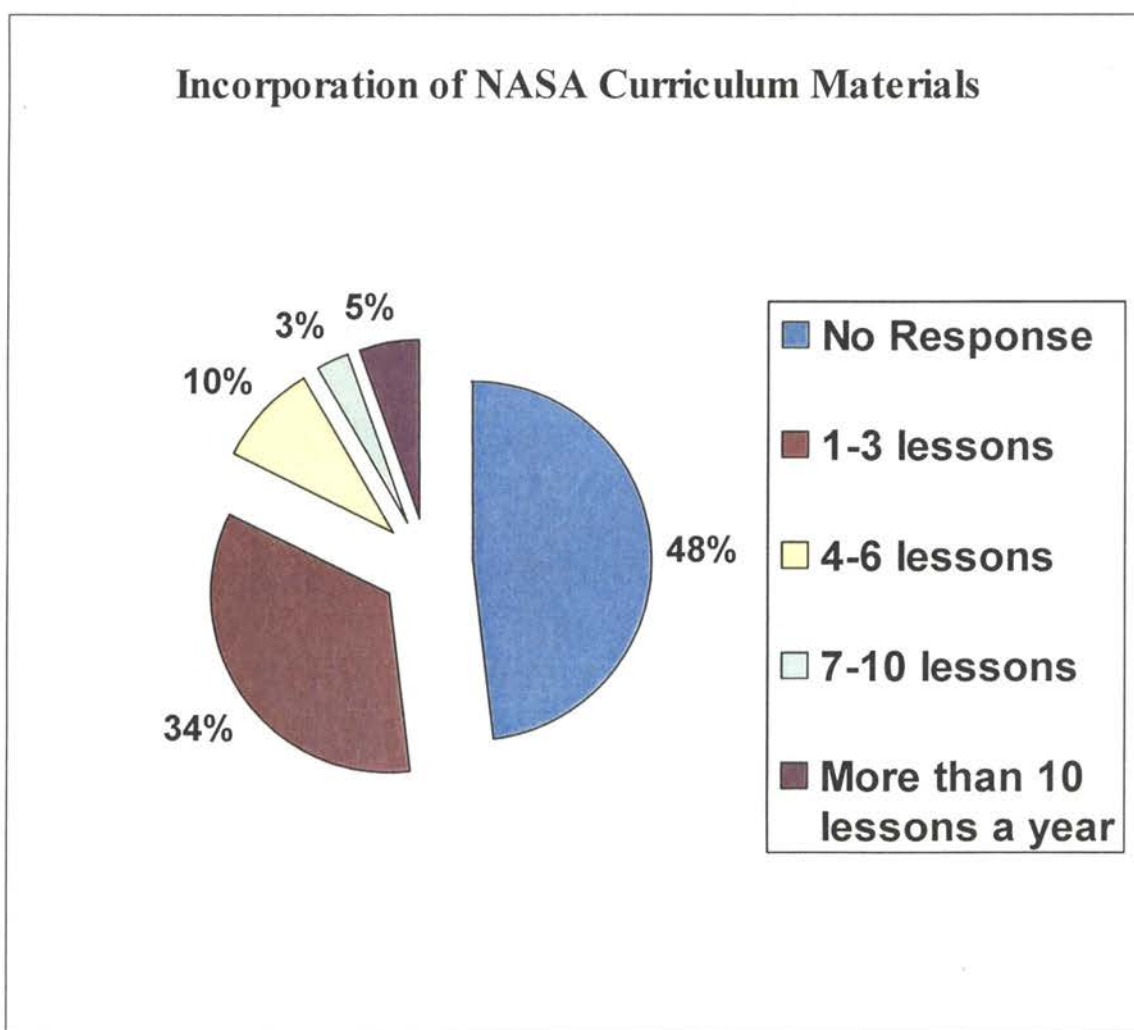
APPENDIX D

CHARTS

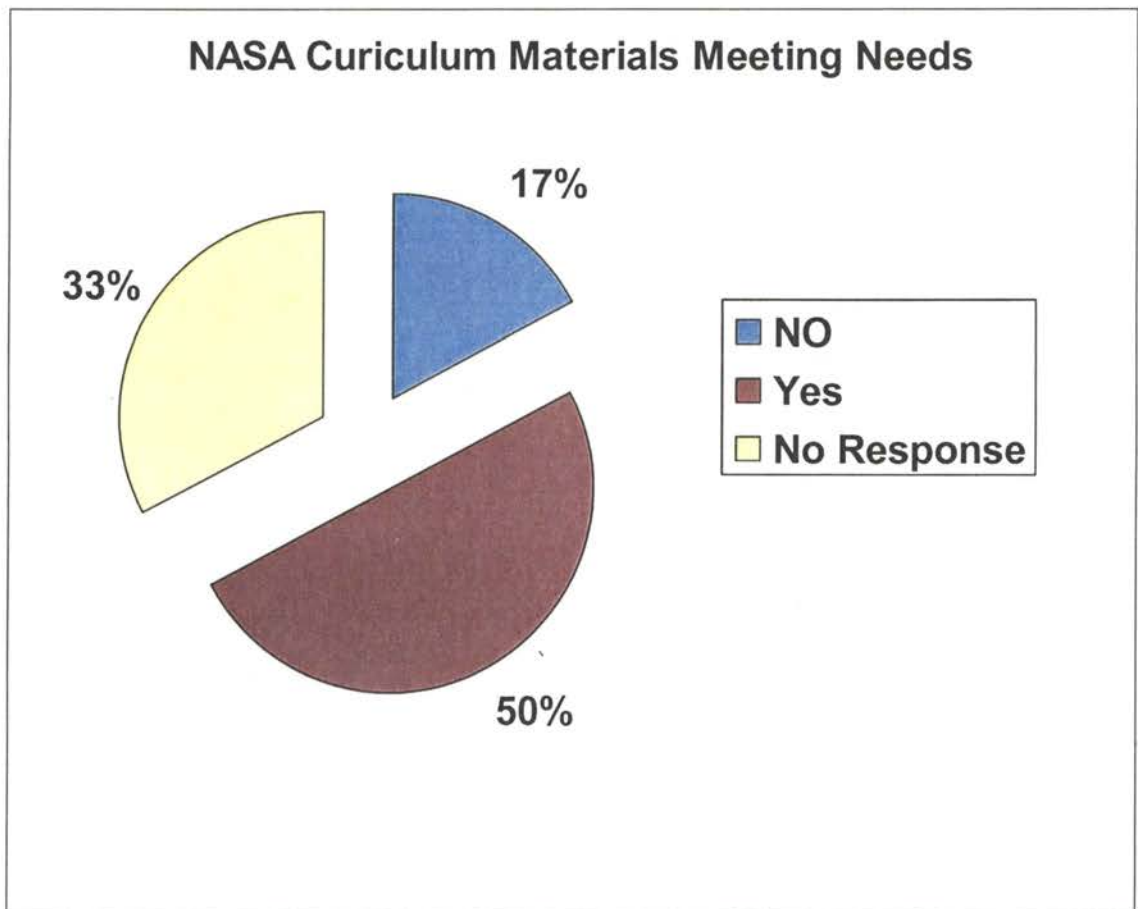
The Utilization Of NASA Curriculum By Educators
of Students with Limited English Proficiency



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APPENDIX E

UCEP OVERVEIW BROCHURE

The NASA Urban and Rural Community Enrichment Program (URCEP) is a NASA Aerospace Education Services Program specifically designed to serve middle school students in urban and rural areas.

SEARCHING YOUNG MINDS

This three-day program is planned, coordinated, and implemented in participating schools by the URCEP team. Using simple demonstrations and scale models of aeronautical and space hardware, the URCEP specialists explain how basic scientific principles are applied in the exploration of aeronautics and space. Major activities include lectures, demonstrations, and hands-on classroom activities that supplement the ongoing curriculum. In addition, workshops and other activities are offered to school personnel.

The program exposes teachers and middle school students from rural and urban communities to interesting and broadening educational activities. Special emphasis is placed on communications, logic, and reasoning skills that are curriculum related. Technical and logistical assistance is supplied by the NASA URCEP coordinator.

The program's involvement in the nation's schools has been extensive. Since 1981, over 75 systems, 900 schools, 1,826 administrators, 10,255 teachers and 940,314 students from urban areas have benefited from URCEP activities.

In preparation for the three-day program, NASA URCEP Specialists train core educators as a team to conduct interdisciplinary aerospace activities in school districts. Superintendents, with suggestions from principals, are asked to select core teachers from schools in their districts. The core educators devote six weeks to working with the aerospace program in their schools where they lead interdisciplinary teams of teachers in interactions with the principal and faculty. They also ensure that all preparations are made for implementing the aerospace programs.

The teams of educators that work with the core educators are selected by the principals of the participating schools. They must represent different disciplines in the school such as mathematics, science, physical education, social studies, fine arts and language arts. The number of educators participating on a team is unrestricted.

To Apply: Interested school systems may obtain additional information by writing to: NASA Headquarters; Education Division; Attn: URCEP Program Manager; Code FE; Washington, DC 20549

APPENDIX F
INSTITUTIONAL REVIEW BOARD
APPROVAL FORM

**Oklahoma State University
Institutional Review Board**

Protocol Expires: 11/27/2001

Date: Tuesday, November 28, 2000

IRB Application No ED0147

Proposal Title THE UTILIZATION OF NASA CURRICULUM BY BILINGUAL EDUCATORS AND ITS
IMPACT ON CLASSROOM INSTRUCTION

Principal
Investigator(s):

Hector Manuel Vasquez
756 Citrus Cove Dr
Winter Garden, FL 34787

~~Associated~~ *Steve Mart*
~~Address:~~ *300 Cockrell North*
Stillwater, OK 74078

Reviewed and
Processed as: Exempt

Approval Status Recommended by Reviewer(s): Approved

Signature:

Carol Olson

Carol Olson, Director of University Research Compliance

Tuesday, November 28, 2000
Date

Approvals are valid for one calendar year, after which time a request for continuation must be submitted. Any modifications to the research project approved by the IRB must be submitted for approval with the advisor's signature. The IRB office MUST be notified in writing when a project is complete. Approved projects are subject to monitoring by the IRB. Expedited and exempt projects may be reviewed by the full Institutional Review Board.

VITA

Hector Manuel Vasquez

Candidate for Degree of

Doctor of Education

Thesis: THE UTILIZATION OF NASA CURRICULUM MATERIALS BY
EDUCATORS OF STUDENTS WITH LIMITED ENGLISH PROFICIENCY

Major Field: Applied Educational Studies

Biographical:

Personal Data: Born in Bridgeport, Connecticut, January 1, 1965, the son of Modesto and Candida Vasquez.

Education: Graduated from Bassick High School, Bridgeport, Connecticut in 1983; received Bachelor of Science degree from Langston University, Langston, Oklahoma, with a major in Early Childhood Education in May, 1988; received Master of Science degree from Oklahoma State University, Stillwater, Oklahoma, with a major in Natural and Applied Science in May, 1997. Completed the requirements for the Doctorate of Education degree at Oklahoma State University, Stillwater, Oklahoma in May, 2003.

Professional Experience: Facilities Manager/Curriculum Analyst, Life Skills, Walt Disney World, Orlando, Florida, 2001 to present; Assistant Coordinator Urban Community Enrichment Program, Washington, D.C., 1999-00; Facilitated a methods of teaching class at Bowie State University, Bowie, Maryland, 1999-00; Aerospace Education Specialist, Oklahoma State University, Stillwater, Oklahoma, 1995-99; instructed a curriculum support workshop for graduate students at Kansas State University, Wichita, Kansas, 1995-96; Instructor, fourth and fifth grade, departmentalize instruction in mathematics and science, Atlanta Public Schools, Atlanta, Georgia, 1991-95.