Spring 2005 • Volume 8 • Number 1

TEXAS ASSOCIATION FOR BILINGUAL EDUCATION

Affiliate of the National Association for Bilingual Education

The TABE Journal

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TEXAS ASSOCIATION FOR BILINGUAL EDUCATION

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Spring 2005 • The TABE Journal • Volume 8, No. 1

Information about TABE

Through a balanced program of research, professional development, and public education, TABE pursues the implementation of educational policies and effective bilingual-bicultural programs that promote equal educational opportunity and academic excellence for language minority students. TABE firmly believes that only enrichment (additive) forms of bilingual education ensure that language minority students are successful academically and develop age-appropriate English proficiency. To this end, TABE fully endorses and promotes the implementation of research-based two-way/dual language programs and maintenance (late-exit) bilingual programs.

In keeping with this fundamental mission, TABE is committed to the following guiding principles:

To serve as a professional association for persons interested in bilingual education;

- To review and analyze the state of bilingual-bicultural education in Texas schools and exchange ideas and practices for more effective implementation;
- To study legislation at the state and national level affecting the educational needs of linguistically and culturally diverse children;
- To exchange educational data, studies, ideas, practices and information with policy-making bodies, such as the Texas Legislature, the State Board of Education, the Texas Education Agency and the United States Department of Education;
- To ensure that Texas public schools provide all students with a program of instruction and cultural development that enhances the student's sense of identity and fosters a positive self-concept;
- To ensure that Texas public schools develop, through academic instruction, the native language and cognitive skills of non-English background students, and that all students become proficient in English plus one or more languages.
- To ensure that language minority parents are involved in the educational development of their children and included in decision-making processes affecting their children's education.
- To collaborate with institutions of higher education to ensure the implementation of quality teacher preparation programs.

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The Beauty of Dual Language Education

Virginia P. Collier and Wayne P. Thomas

George Mason University

We ascribe beauty to that which is simple; which has no superfluous parts; which exactly answers its end; which stands related to all things; which is the mean of many extremes.

Ralph Waldo Emerson

First of all, what does it mean to be "elegant?" Roughly what I think this means is that a huge amount of structure is packaged in a small number of simple principles.

Peter Woit

Mathematicians and physicists speak of beauty and elegance in scientific explanations that are simple but powerful. But do these concepts apply to dual language education? We believe that they do. Dual language schools provide a large amount of infrastructure and powerful instructional strategies with which educators can carry out meaningful reform that addresses student needs by fully closing achievement gaps and providing an enriched education for both English learners and native-English speakers.

Picture the most magical moment that you can envision; something that you want your own children and grandchildren to experience. What would your dreams make happen for your beloved family?

When I (Ginger) close my eyes and wander back into my childhood memories, one of my favorite images is giggling and chatting in Spanish with my friend Osminda, who taught me poems, music and games in her one-room dirt-floor home full of love in Honduras. Or picture grandson Julian bouncing and belting out, "Juancho Pancho tiene un rancho, ayayayayay!" Origami, live animals, movement and dance, storytelling, puzzles, sharing memories, weaving, music-making, planting, cooking, finding out secrets, learning survival skills, authoring ... all these things and a million more magical happenings we have experienced in dual language classrooms. Now try to visualize the impact of a dual language school on all the different participants.[1]

Dual Language Influences on Participants

Parents. Parents grow with the program. A good dual language school becomes the family's second home. The bicultural context nurtures everyone. Parents of all walks of life come together to share their joys and challenges. Schools that keep their doors open in the evenings and weekends can provide a multitude of bicultural experiences for families from literacy development, to cross-language learning and cross-cultural events for all ages. As families come to value their neighborhood dual language school, they work harder to find ways to stay, so that their children can attend the school for as many grades as possible.

Both Spanish-speaking and English-speaking parent groups become advocates for the development of bilingualism in the community. A core of committed parents can stem the political forces that might question the value of bilingualism, locally or even statewide. Parents have power when mobilized; some dual language parents have successfully challenged state legislators and policy makers when needed. Funding appropriations for dual language schools and policies that promote bilingualism and biliteracy for all citizens are outcomes advocated by parents committed to schooling their children through two languages.

Administrators. Principals of dual language schools truly love what they do. They stay in these positions forever, it is hard to persuade a dual language principal to retire. The commitment to the community and the joy of creating a bicultural gathering place is a stimulus for staying, as principals see the magic happening in their schools.

Granted, first year implementation of dual language is challenging. Some major challenges include understanding the program, building teacher and parent support, providing intensive staff development, and finding truly proficient bilingual teachers as the program grows grade by grade. This takes patience and confidence. Extra funds are often sought for the startup years, to purchase curricular materials in both languages and to provide extra staff development for teachers. This involves seeking grant funds and can lead to community business partners who support the school. Central office administrators working in collaboration with principals of dual language schools often establish a support system that provides the resources needed. With time, the results in student achievement gains make everyone proud that they all played a part in developing these schools.

Teachers. We have heard teachers in dual language schools say things like, "This is heaven," or "I'm having a blast." Visiting classrooms, we see the beaming smiles on teachers' faces, the pride reflected in students' creativity, that attitude that we can do anything in two languages no problem! Teachers who are deeply proficient in the languages of instruction are also deeply bicultural. The cross-cultural experiences they have had in life lead to creativity in their teaching practices, as they create family in their classroom and want to share their intimate knowledge of varied ways of learning with their students. Dual language teachers expect students to become profoundly proficient in the languages of instruction, grade by grade, through exploring fascinating themes in depth and connecting to community concerns.

Planning time for teachers is an integral part of each school week in a dual language school. The shared resources and teaming that emerges from the planning process makes best use of the talents each teacher brings to the school. Heads together, teachers are much more creative in curricular planning and student behavioral concerns that need to be addressed. Dual language teachers often support each other and become close friends. Because the curriculum is bilingual/bicultural, the community link is a natural one that leads to teacher-parent partnerships in the learning process. Teachers make use of parents' knowledge and cross-cultural life experiences as resources for classroom learning.

Students. Proud, confident, excited, beaming faces students know they're attending the "cool" school, and they show it in their hard work. It's really not at all easy to be able to do math, science, social studies, art, music, language arts through two languages. But students from severe poverty as well as other difficult circumstances have proven themselves up to the challenge. Whatever students' life circumstances have been, all groups have thrived in dual language education, with students in the dual language classes achieving significantly higher than comparable groups getting schooled only through English.

Students speak proudly of their academic accomplishments, confident in their growing bilingualism. Student graduates state that the program changed their lives. They find that as proficient bilinguals, they are highly desirable in the 21st century world of work, and they experience personal and professional richness that crosses cultures and languages.

Student achievement. Research findings from numerous studies demonstrate the power of this program to enhance student performance in school (e.g. Lindholm-Leary, 2005; Thomas & Collier, 1997, 2002; Collier & Thomas, 2004). For example, in Houston Independent School District, students attending the two-way dual language classes achieved above grade level in Grades 1-5, both in Spanish and in English, following the same students longitudinally for the years 1996-2000, as measured by the norm-referenced tests Stanford 9 and Aprenda 2. This was true for Spanish-speaking students who were classified as English learners, as well as for English-speaking students. Hispanic, European-descent, and African-American students, including those on free and reduced lunch, all scored on or above grade level. In many other school districts we have found similar achievement levels in dual language classes, with students continuing on or above grade level throughout the middle and high school years.

What is truly remarkable is that English learners in a dual language program can outpace native-English speakers in monolingual classes. Year after year, English learners in dual language classes gain more than one year's progress in their second language, until they reach grade level in both first and second languages. Native-English speakers have the advantages of being schooled through their own language, with nonstop cognitive and academic and sociocultural support. Their language and identity is not threatened, because English is the high status language. But in spite of this huge advantage, English learners can outperform native-English speakers when they are schooled in a high quality enrichment program taught through their home language and English.

Characteristics of Dual Language Education

So what are some of the major differences between dual language and transitional bilingual education? Texas educators are very experienced with transitional programs. But dual language programs are now expanding rapidly throughout the state. Bilingual educators need to know how to "transition" from transitional to dual language.

Enrichment, not remediation. Overall, the word "enrichment" best describes the goal of a dual language program. Whatever circumstances students have been through in the past, a dual language teacher views all students as gifted. Through peer teaching in cooperative learning settings, students are challenged to think creatively and to assist each other with language development as they solve "real-world" problems through thematic units across the curriculum. Each planned activity has multiple levels of language and cognitive development embedded in the tasks, helping students make leaps in their learning.

Separation of the two languages. Dual language emphasizes the development of deep proficiency in each language, because students will be using both languages for all curricular subjects, as they move through the school years. To do equally well in a calculus course, whether it is taught in Spanish or in English, requires conceptual background and deep proficiency in the language of instruction. That means that students must take very seriously the tasks of constantly expanding their vocabulary, and building reading and writing skills appropriate to their grade level, for each language, in each subject area. When translation or code-switching (going back and forth between the two languages) is used in the classroom, students who are not proficient in one of the languages may not develop the deep proficiency needed to function in both academic Spanish and academic English. Separating the two languages by theme or subject, by time of day, or by day of the week, provides clear messages to students that both languages are equally important. When lessons are not repeated in the other language, students take the work seriously. With time they are proud of the academic challenge they have been given to develop age-appropriate skills in each language, year after year.

Focus on the core academic curriculum. Critical thinking is embedded in all curricular tasks of the dual language program. No more watered down instruction is allowed. Even when students are not yet proficient in the language of instruction, lessons are meaningful while cognitively complex and age-appropriate. The goal is to help students accelerate their growth, reaching grade-level achievement in both their first and second languages. Thematic teaching allows students to dig into a topic in depth, exploring all subject areas through material that connects to life outside the classroom. Meaningful academic content leads to natural first and second language acquisition.

Length of the program. This is the biggest difference between transitional and dual language. Dual language is the mainstream. It is not a special remedial program for students perceived as having "problems." It is a classroom just like any other classroom; simply taught through two languages. All students are welcome to enroll in a dual language program. No one should be turned down, when entering the program in kindergarten or first grade.

Students do not beg to be moved out of the dual language class. They are now perceived as gifted. Improved social relationships develop among students of varied linguistic, cultural, and economic background attending the dual language classes. Students are respected and valued as equal learning partners with their classmates.

Parents do not want the program to end. Often an elementary school that has developed a dual language program works on articulation with its feeder middle school, to continue the program beyond the elementary school level. High schools are increasingly offering some academic courses for credit in Spanish, when students have attended dual language Spanish-English elementary and middle schools. Ultimately, dual language will become a PK-12 program. This fully prepares students with bilingual/ biliterate/bicultural proficiency and knowledge that is invaluable in the 21st century world of work.

The Beauty of Dual Language

In physics, an elegant scientific theory is simple and powerful. That's the beauty of it. This educational program has a simple, well-defined theory, with measurable variables, and outcomes that respond to input. It is consistent with well-founded educational, linguistic, and social science theory. The high outcomes of dual language are consistent with its predicted outcomes. The program is maximally effective in the early years of school, when the gap is easiest to close, and thus it puts students in a better position for achieving on grade level in the middle and high school years, when the cognitive demand of instruction is high.

Amazingly, dual language is also politically attractive, with majority support. Many of the voices in opposition to bilingual education are supportive of this particular model of bilingual schooling. Designed for all students, rather than being divisive and isolating, this program is integrative and inclusive. Because dual language is a vehicle for school reform, it meets the needs of students, educators, and the whole community.

Dual language successfully meets the disparate needs of many groups of students. The program accelerates instruction for English learners, provides achievement gap closure for bilingual students who are classified as fluent in English but achieving below grade level, and it is also gifted instruction for native-English speakers. Dual language is a vehicle for bringing many different students together to learn from each other. The social interaction leads to improved social relationships between groups and friendships that last a lifetime. Bicultural perspectives acquired in the dual language program lead to lifelong aspirations for collaboration across ethnic and class boundaries. Student graduates of dual language have stated, "It opened us to a whole new world." and "I can't thank my teachers enough; it totally changed my life."

Footnote:

1. For less repetition, all examples in this article refer to Spanish-English dual language programs, since Spanish is the second major language of Texas. But in other U.S. states, there are also flourishing dual language programs in English and, for example, Korean, Chinese, Japanese, Arabic, Navajo, Russian, as well as other languages.

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The State of Texas: Breaking New Ground in Dual Language Instruction

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Abstract

This article focuses on the growth, description and analysis of two-way immersion programs in the US and in Texas. It presents characteristics of the model, provides a historical overview of its development, analyzes current initiatives in Texas to support its implementation, and finally discusses implications for higher education.

Introduction

Since the inception of dual language instruction in the sixties, a variety of models have emerged to address the educational needs of English language learners (ELLs) in the United States. Prevalent educational philosophies, as well as political considerations, have contributed largely to the design of these models, dictating factors such as goals and length of programs, language distribution, and type of student population served. In the last four decades, we have witnessed the creation and growth of transitional bilingual education, maintenance bilingual programs, also called one-way dual language, and more recently, the two-way immersion programs. Development and promotion of the latter program constitutes one of the new trends in the ever-changing educational policies in the United States, as evidenced by the remarkable growth of two-way immersion programs, especially in the decade of the nineties. Currently, the directory compiled by the Center for Applied Linguistics (CAL), which uses well-defined and rather restrictive criteria for inclusion, indicates that 175 school districts across 28 states (plus D.C.) are currently offering two-way immersion programs (CAL, 2005). This article analyzes the growth, description and analysis of two-way immersion programs in the US and in Texas. We will first present characteristics of the model, then provide a historical overview, and finally, analyze current initiatives in Texas to support its implementation.

What is Two-Way Immersion?

The two-way immersion (TWI) program is an instructional approach that integrates native English speakers and native speakers of a second language and provides instruction in both languages (Howard, Sugarman, & Christian, 2003). This educational model has been referred to in the literature as two-way immersion (bilingual) programs (Howard, & Sugarman, 2001; Thomas & Collier, 2002; Lara-Alecio, Galloway, Irby, Rodríguez, & Gómez, 2004; 2-Way CABE, 2005), two-way bilingual education programs (Christian, 1994; Ovando, Collier, & Combs, 2003; Crawford, 2004; CAL, 2005), two-way dual-language programs (TTC, 2005), and dual language education programs (DLENM, 2005). Since these programs are now taking center stage in discussions about multilingual and multicultural educational needs of all US students, it seems appropriate to present a clearer definition. In view of the fact that in these programs native English speakers and native speakers of other languages receive instruction in the two languages used in the program, several questions arise pertaining to the number of participating students from each language group, the amount of time they spend in joint educational activities, the language used for initial literacy development, and the perceived value or status of each language. For example if a program serves 18 Spanish-speaking and 5 English-speaking students, can it qualify to be considered a TWI program? Similarly, if the student populations are integrated for one class period per day or per week, should it be called a TWI program? If the program serves English native speakers and Spanish native speakers from the same ethnic group, can this be considered two-way? To address these questions, we used three sources which, although pursuing different goals, provided valuable information.

First, the well-known longitudinal research conducted by Thomas and Collier (2002) comparing the outcomes of various educational models has been one of the most extensive studies to date and has given rise to many follow-up articles. In an article summarizing their research in the area, Collier and Thomas (2004) specified the criteria used for the selection of two-way dual language programs used in the 2002 study:

> Two-way classes … do not need to enroll exactly 50% of each linguistic group to be classified as two-way, but it helps the process of L2 acquisition to have an approximate balance of students of each language background. For our data analyses, we have chosen a ratio of 70:30 as the minimum balance required to have enough L2 peers in a class to stimulate the natural second language acquisition process (p. 3).

In our second source, the Directory of Two-way Bilingual Immersion Programs in the U.S, the Center for Applied Linguistics adds well-defined criteria for inclusion in the directory, thus providing characteristics of the program. Programs considered for inclusion in the two-way directory must meet all three of the following criteria (CAL, 2005):

> Integration: Language-minority and language-majority students are integrated for at least 50% of instructional time at all grade levels.
>
> Instruction: Content and literacy instruction in both languages is provided to all students.
>
> Population: Within the program, there is a balance of language-minority and language-majority students, with each group making up between one-third and two-thirds of the total student population.

Finally, in Texas, the Texas Two-way Consortium (TTC) in 2000-2001 conducted a survey to collect data on two-way bilingual programs in the state and, together with Texas A & M University, established a registry whose main goal is to identify and provide support for two-way bilingual programs (Lara-Alecio et al., 2004). To maintain an accurate account of programs, the group developed a website where districts can register and update information on their programs. Since the registry focuses on data gathering and supporting existing programs through the creation of an information network, no specific criteria are mentioned for inclusion in it. However the data requested by TTC provide an outline of the characteristics exhibited by two-way bilingual programs reported in the registry. Features derived from the questionnaire include the language used for initial literacy instruction, as well as the percentage of the school day in which students are integrated. Interestingly, among the possible responses to the last question, the TTC provides a range as high as 100% to as low as 10%. The dichotomy of language minority/language majority is not addressed in the questionnaire; instead, it asks about the percentage of integration between native English speakers and native Spanish speakers. Compared to the CAL criteria, these features allow for a much broader array of programs, including programs which might not qualify as TWI programs, as defined in CAL.

After analyzing the characteristics of two-way programs from these sources, we have found one main difference between the characteristics presented in the CAL website and the program characteristics gathered from the TTC website. The main point of disparity comes from the use of the terms, "language-majority and language- minority" by CAL and the use of "English native speaker and Spanish native speaker" by TTC. Based on the way that these terms are used by both groups, it is important to seek clarification. To address this question, we conducted a search and found the following two definitions:

> 1. "English language learners...fall within the larger category of language minority students, which can also include students who speak varieties of English other than mainstream English as a first language" (Butler & Stevens, 1997, p. 9).
>
> 2. "Language minority students – This term refers to individuals from homes where a language other than English is actively used, who therefore have had an opportunity to develop some level of proficiency in a language other than English. A language-minority student may be of limited English proficiency, bilingual, or primarily monolingual in English" (DBASSE, 1998, p. 1)

Based on these definitions, we can extrapolate that the term "language-minority" can describe native Spanish-speakers, native English-speakers of Latino ancestry, bilingual Spanish-English students, and any other language group that speaks an English variety different from mainstream groups, which can include even speakers of Ebonics. Based on this analysis, the term

"language-majority" students applies mainly to middle class children from European descent who speak Standard English. Now, the key question still remains, what definition is CAL using? To find a definite answer to this question we contacted the President of the Center for Applied Linguistics, Dr. Donna Christian. In her communication, she indicated that " …for the purpose of two-way immersion, language-majority students are those who are English dominant; language minority students are those who are dominant in Spanish or another non English language."(personal communication, February 28, 2005).

After an analysis of the information presented in Thomas & Collier (2004), the response from CAL, and the questionnaire from the TTC (2005), three program characteristics were identified. These will be added to the initial definition (Howard et al., 2003) presented at the beginning of this section to read as follows: The two-way immersion program is an instructional model that integrates native English speakers and native speakers of another language, provides instruction in both languages used in the program, and contains the following features:

1. a balance of English native speakers and speakers of another language within the program (Thomas & Collier, 2002; CAL, 2005),

2. an integration of English native speakers and speakers of a second language in the program for a specified percent of instructional time (CAL, 2005), and

3. the delivery of content and literacy instruction in the two program languages (CAL, 2005).

Since there is no agreement among the three sources consulted on the specific percentages of population balance and integration instruction, these were excluded from the definition used in this article.

Growth of Two-Way Programs in the Nation

Traditionally, we have been taught that the origin of the two-way programs can be traced to the two-way immersion programs in Canada and the Saint Lambert experiments beginning in 1965 and described in Lambert & Tucker (1972). However, in 1962 a private school in Massachusetts, the Ecole French/English school, began implementing dual language instruction (CAL, 2005; Ecole Bilingue, 2005). The Ecole Bilingue project was followed by the program at Coral Way Elementary in Florida, which has traditionally been considered the first bilingual education program of the 1960s (Crawford, 2004) and a predecessor of modern day two-way bilingual programs (Christian, 1994).

During the three decades following the foundation of the Ecole Bilingue (1962-1992), dual language programs expanded at a very slow pace (CAL, 2005). In 1992 the CAL registry reported only 67 programs nationwide. However, from 1992 to 2000 the creation of these programs skyrocketed. In a period of eight years, the number of programs rose from 67 to our current figure of 280 (CAL, 2005). This increase represents a growth of 317% in less than a decade.

Two events at the national level played an important role in the proliferation of TWI programs in the United States during the nineties. First, the reauthorization of the Bilingual Education Act in 1994 provided more funding for bilingual education and encouraged the development of programs to promote an additive bilingual environment and fluency in two languages (Crawford, 2004). This movement away from the compensatory nature of transitional bilingual education promoted the development of more TWI programs. Second, the federal government welcomed these kinds of programs and adopted an official position in favor of TWI programs. This position was clearly stated in the 2000 speech of the former Secretary of the US

Department of Education, Bill Riley:

> "Proficiency in English and one other language is something that we need to encourage among all young people. That is why I am delighted to see and highlight the growth and promise of so many dual-language bilingual programs across the country. …That is why I am challenging our nation to increase the number of dual-language schools to at least 1,000 over the next five years, and with strong federal, state and local support we can have many more."

In response to this official endorsement and the acknowledgement of the asset of speaking multiple languages, it was natural to expect a healthy growth of dual language programs in the new century. However, with the change of administration in the same year, this endorsement promptly disappeared. Because the TWI programs are more inclusive than traditional bilingual education programs and they serve mainstream children as well as ELLs, we were expecting a more favorable reception at the federal level. But once again, this has not been the case in the last five years; funding for bilingual education has been drastically reduced, and this reduction has definitely curtailed the development of TWI programs at the national level. Fortunately, this has not happened at the state level. For example, in Texas, school districts are seeing the benefit of TWI programs and continue supporting them. The TTC figures reported at the NABE meeting in San Antonio show that in the last three years (2001-2002 to 2003-2004), the TWI programs have increased from 63 to 225 (Galloway, Lara-Alecio, Irby, Rodríguez, & Gómez, 2005), which represents an astounding growth of 257%. Thus, the momentum for TWI is still here, but the source of support might have changed from the federal to the local and state governments. Despite the low funding of the NCLB legislation of 2001-2002, school districts in Texas believe in the TWI model and continue its implementation across the state.

Dual Language Instruction in Higher Education

Up to this point in time, all discussions have centered on K-12 public schools because very little has been done in higher education. However, in the last few years, the interest in dual language instruction in higher education has grown, and today there is at least one university system experimenting with dual language programs – The Ana G. Méndez System (AGMS).

In 2004, the AGMS in Puerto Rico began offering a Spanish/English dual language accelerated learning program in Orlando, Florida (Lamboy, Zayas Seijo, & Burgos, 2005). The university offers intensive degree programs in business administration, criminal justice, psychology, tourism and education (AGMS, 2005). Courses are delivered in a five-week block, alternating languages every week. The program, which began in 2004 with 225 students, presently has an enrollment of 465 students. The future seems promising for this venture, and currently university officials are looking for additional sites to expand the program. This trend in higher education, as well as in public schools, is expected to continue in the future as long as the public support for dual language programs continues.

Dual Language Programs in Texas

Texas is one of the states with the longest bilingual education tradition in the United States. Following the establishment of the first dual language programs in the United States in the 1960s, school districts in Texas began experimenting with bilingual education (Bernal, 1994). In 1964 the Laredo school district established the first official bilingual education program in Texas (Rodríguez, 1996). Following the lead of Laredo, other districts in San Antonio, Corpus Christi, and several districts in the Rio Grande Valley began implementing programs. In 1965 the National Education Association collected data on innovative bilingual education programs from five Southwestern states including Texas. Two innovative bilingual

education programs in Texas were cited in this report - El Paso and Laredo (Bernal, 1994). As a result of this emphasis in bilingual education and the pressure of Latino organizations, in 1969 the Texas legislature passed a bill permitting the use of a language other than English for instruction in public schools. This bill ended the no-Spanish rule in Texas public schools and opened the field for development of bilingual education in Texas (Rodríguez, 1996). In 1973, Senator Carlos Truán and Senator Chet Brooks introduced and guided to fruition the first Bilingual Education Act in the state (Bernal, 1994).

Since its official beginnings in 1973, Texas has shown a consistent commitment to bilingual education and more recently to one-way and two-way immersion programs. Based on this commitment, it seems natural for the state to take leadership in the development of TWI programs. The CAL registry dated the first TWI programs in Texas to 1992, and since that day, these programs have multiplied throughout the state (CAL, 2005). According to the 2005 CAL data, Texas has the second largest number of TWI programs in the nation. The data show that in 2005 the state had 52 schools implementing TWI programs in 23 school districts. However, these figures differ drastically from the 225 programs currently listed in the TTC website (2005). Based on the figures reported by the TTC, Texas is the state with the largest number of dual language programs in the United States (TTC, 2005; Lara-Alecio, & et. al., 2004).

With the notable exception of Region IV in the Houston area, most dual language programs in Texas are located in communities around the US/Mexico border. Region I in the Rio Grande Valley leads the state with 58 programs, followed by Region IV in the Houston area with 37, and Region IX in El Paso with 35 programs (TTC, 2005). These three regions alone account for 74.6% of all TWI programs in Texas (Lara-Alecio & et. al., 2004). The growing number of dual language programs in the state represents a clear commitment from progressive school districts in support of quality dual language instruction for all children in Texas.

The Need for Dual Language Teachers

The availability of qualified dual language teachers is one of the most challenging issues for the success and future development of TWI in Texas and in the nation (Howard & Sugarman, 2001). This success is contingent on the willingness of the state legislatures to develop the infrastructure to produce adequate numbers of TWI teachers to meet new demands and to provide support for programs already in place. The need for funding to provide in-service training is especially important to the large number of new TWI programs which are using teachers prepared in traditional compensatory bilingual education programs.

Currently, the state of Texas does not require a specialized dual language certification to work in TWI programs. The absence of a dual language instruction certification in the state forces school districts to rely on a small pool of state and national experts to develop the in-house expertise needed to support new and existing programs. A review of degree plans from leading teacher preparation programs posted on-line showed that institutions of higher education (IHEs) in Texas have not established undergraduate programs to produce teachers with specialized knowledge in TWI. Some of these universities are sponsoring regional dual language conferences and institutes to provide in-service training to teachers. Up to this point, only one university has a master's degree with emphasis in dual language instruction. Some universities are infusing TWI programmatic features into their teacher preparation programs, while others are still relying on traditional bilingual education programs to prepare dual language teachers. The growth of TWI programs in the nation and in Texas has created a need for IHEs to develop or revamp programs to prepare teachers and administrators in the field of two-way dual language instruction. This need is especially true for the state of Texas, with its 225 active dual language programs (TTC, 2005).

Texas Initiatives to Support Dual Language Programs

Effective dual language programs use teachers who are highly proficient in the languages used for instruction. In the state of Texas these languages of instruction are largely Spanish and English. The No Child Left Behind (NCLB) legislation indirectly paved the way to ensuring that bilingual and dual language teachers in Texas possess the Spanish language proficiency needed to be effective language teachers. The legislation requires districts to hire qualified bilingual personnel who are proficient in the languages used for instruction (NCLB, 2002). To comply with this legislation, the Texas State Board for Educator Certification (SBEC) is developing a certification examination designed to ensure that bilingual/dual language teachers have the appropriate proficiency in listening, speaking, reading and writing in Spanish. The standards for the new test are already available to the public (SBEC, 2005), and beginning in the fall of 2006, teacher candidates seeking bilingual/dual language certification will be required to pass the Bilingual Target Language Proficiency Test - Spanish. The test will replace the current Texas Oral Proficiency Test (TOPT), which assesses only the speaking ability. By using a more stringent test to assess proficiency in Spanish, the state will assure that only teachers with the required proficiency in Spanish become certified to teach in bilingual/two-way immersion programs.

The development of dual language programs has convinced a group of Texas legislators to embrace and support these programs by creating an infrastructure to ensure their success. Currently, there are two bills in the Texas State Legislature to amend the Texas Education Code in support of bilingual and dual language programs- Senate Bills 61 and 78 (2005).

Senate Bill 61(2005) was introduced by Senator Royce West from Dallas, and it calls for the creation of the first "dual-language instruction" certification in the nation. To provide additional support for dual language teachers, the bill also calls for the creation of a Master Language Teacher certification program, together with special funding to support teachers seeking this certification. Teachers with the Master Language Teacher certification will provide technical expertise and supervision to dual language teachers to ensure that students improve their performance in English and other languages. To increase the pool of teacher candidates seeking dual language instruction, the bill also provides financial assistance through the current Instructional Aide Tuition Exemption Program to full-time instructional aides who demonstrate financial needs and who are seeking certification in bilingual, ESL or dual language certification. The last component of this bill calls for the creation of an International Teacher Exchange Program to allow language teachers in Texas the opportunity to travel abroad, and/or receive language teachers from selected countries to exchange expertise in the various languages used for instruction in Texas.

The second bill, introduced by Senator Eliot Shapleigh from EL Paso, calls for the creation of a two-way developmental bilingual education pilot project to examine the long term effects of this model and its potential to help increase high school graduation rate. This bill allows the opportunity to examine the long-term benefits of the program using research-based information, which can potentially pave the way for an expansion and increased funding of the program. At the time of this writing, both bills have had their first reading and have been referred to committees. If Senate Bills 61 and 78 are approved, Texas will become the only state in the nation with a "dual language instruction" certification program and the only state with an official endorsement of two-way immersion as the program to meet the language needs of children in Texas.

Implications for Higher Education

Senate Bills 61 and 78 represent a wake up call for teacher preparation programs in Texas. With the approval of the "Dual Language Instruction" certification, teacher preparation programs will have to

evaluate existing programs and determine how different the curricula need to be to prepare candidates for this certification. Even if these bills fail, the need to prepare dual language teachers is already evident in Texas. Colleges and universities need to be proactive on this issue, assess current needs and make projections to support districts implementing dual language programs. But first IHEs must understand the implications of having a dual language instruction certification and find answers to key questions: How different would dual language instruction be from the traditional bilingual certification? Should the dual language instruction certification program replace the bilingual certification? Or should we have two different certification programs, one for early exit TBE and one for late exit dual language programs? What are the characteristics of effective dual language teachers? What kind of pre-service and in-service programs is needed to prepare dual language teachers? All these questions require close examination and can provide important information for the development of certification standards for teacher preparation programs.

Currently, there are no national or state standards for the preparation and certification of TWI teachers. There are state initiatives to develop standards for the design and implementation of K-12 programs, but no attempt has been made to link these to teacher preparation (D. Christian, personal communication, February 28, 2005). We identified two state initiatives and one at the national level to guide school districts in the design and implementation of dual language programs. The Division of Bilingual/ESL Education of the Texas Education Agency is currently developing the standards for Dual Language Immersion programs (González, 2005). At the time of this writing, the standards were still in a draft format, but the expectation is that these will be finished in the near future. A second state initiative comes from the Dual Language Education of New Mexico (DLENM), which developed dual language standards for the implementation and self-evaluation of these programs (2005). At the national level, the Center for Applied Linguistics is currently using the New Mexico standards as a foundation for the development of the national dual language program standards for K-12 schools. A careful analysis of these and other state initiatives can provide the groundwork for the development of standards for TWI teacher preparation programs. Once these standards are in place, IHEs can develop programs to prepare teachers to meet the needs of TWI programs in the state and the nation.

Conclusions

The success of two-way immersion programs depends on the availability and commitment of quality teachers and the support of school administration and the public, in general. In the state of Texas, the state legislature is making an attempt to address part of these components through the creation of the infrastructure to prepare qualified dual language teachers (SB 61) and to secure the support of the public through a pilot program to gather data on the effectiveness of TWI programs (SB 78). While in states like California and Massachusetts, the English-only and anti-immigrant movement is taking away support from ELLs, in Texas we want to increase this support in the form of two-way immersion programs. The two bills represent a radical movement even for a state with a long commitment to bilingual education. The two-way dual language program is able to secure public support because of its ability to serve both ELLs and mainstream children. Based on the political and economic environment in the nation, the program is perhaps the best way to insure the continuity of language programs to meet the needs of ELLs in the state.

To ensure the success of the state's dual language initiatives, more IHEs have to support these efforts. They need to establish meaningful collaboration with public schools and create programs to prepare teachers and administrators for TWI programs. The bills in the legislature might fail to become laws, but this should not take away from the pledge expressed by members of the legislature and the commitment needed from higher education. Now that the Texas Education Agency is developing the TWI standards for public schools, colleges and universities need to work with the state and school districts implementing dual language programs and jointly develop the standards for the preparation and certification of TWI teachers.

Once the standards are in place, these could be infused into their traditional bilingual teacher preparation curricula. If the bills are approved and dual language certification becomes a reality in Texas, IHEs will be ahead of the game and dual language certification programs will be easily implemented. By adopting this proactive approach, colleges and universities in Texas will become real partners with the state of Texas in breaking new grounds in dual language instruction.

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Author Note

I would like to express my gratitude to Dr. Avigail Vicente for her valuable contribution to this article. I would also like to thank Ms. Christina Jones-Barnes for her support in gathering articles for the review of theliteratura

Essential Beginnings for Dual Language Programs

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Abstract

The highest growing population of students U.S. public schools are second language learners. An ideal format for educating these students is through dual language programs where children from two language groups learn each other's languages. Excellent practitioners in dual language programs preserve high standards while providing academic instruction in two languages. These programs hold a benefit for Spanish and English dominant students by adding a second language to every student's repertoire of skills. As school officials form new dual language programs, however, these programs often manifest similar challenges. The objective of this article is to offer some perspective into eight of the essential components all practitioners in dual language programs often encounter as these new programs are formulated.

Dual language bilingual education is at the forefront of meeting the needs of all U.S. school children today (Lessow-Hurley, 2005; Lindholm-Leary, 2001). Programs provided in two languages with a heterogeneous population of culturally and linguistically diverse (CLD) learners are usually referred to as "Dual Language" programs. These programs teach a second language to all children while increasing aptitude in their first language. In many areas of the southwest, an example of this would be English and Spanish speakers learning their second language. In the absence of a heterogeneous population where there are monolingual speakers of each language group, "Language Immersion" programs develop. These programs usually offer academic instruction through a minority language to English dominant students who have little or no home access to the minority language.

Motivated teachers and administrators establish new dual language programs every day. Highly involved parents inspire many of these programs with language learning goals for their children. Cognitive research in the field of language learning indicates that good dual language education facilitates the learning of two languages for all learners (Calderón & Minaya-Rowe, 2003; Pérez, 2004). Proficiency in the home language has been shown to predict the success of language acquisition in the second language (Krashen, 1999). For this reason, dual language and language immersion programs benefit everyone.

Programs that have been established for some time differ in various characteristics from those programs that are new to the faculty, administration or community (Montague, 1999; Montague & Lucido, 2005; Montague & Meza-Zaragosa, 1999; Lucido, Aguilera, Leo, Berlanga & Montague, 2000). This article previews some of the components identified thus far that appear essential when initiating a new dual language program with a heterogeneous population.

Essential Components

Careful attention to addressing these essential components is best if conducted in a combined team approach. When this team effort occurs between administrators, teachers and parents, it can make a distinctive difference when establishing a successful program for long-term success.

Finding the Dual Language Model

Some school communities find themselves calling their program simply "Dual Language", providing instruction through two languages. For most parents and some administrators this is an acceptable title. However, many highly skilled Bilingual Education teachers get right to work with the shared goal of facilitating full bilingualism in their students, only to never have the initial conversation identifying the specific model of dual language that will be implemented from a team approach. This is an essential starting point for new programs. The 90/10 model can be highly effective for all language learners (Thomas & Collier, 1997), immersing both minority and majority language learners in 90% of instruction through the minority language. Throughout South Texas and much of the southwest, the two languages of instruction in dual language programs are English and Spanish. In a 90/10 model, 90% of instruction will be provided through the minority language in the preschool classroom, gradually shifting to increasing uses of English instruction in the upper grades until a balance of languages is used by the last grade of elementary school. Teachers in 90/10 programs are highly conscious of the language modeling they provide. Many times, about half of the children in a 90/10 classroom with a heterogeneous population don't understand the minority language. This necessitates immeasurable amounts of energy as these teachers use paralinguistic cues, visual and experiential context and any other reference available to model the language, facilitating understanding for all learners.

With the 50/50 model of instruction, each child's instructional experience is split evenly between languages. These teachers can be seen using different approaches such as splitting each day in half with the morning in one language and afternoon in another, or one day's instruction provided through English and the next day in Spanish. Some dual language teams design a 50/50 program that divides subject matter by language. The format seen most often in this variation is provision of the highly contextual curriculum areas of mathematics and science provided in the minority language while social studies, language arts and history are provided in the majority language of English. Throughout many schools in the southwest, Spanish is the minority language used for math and science instruction (Lucido, et al., 2000).

New programs are often developed quite often as an increasing number of community members and educators realize the value of dual language programs. New dual language programs need to begin with a team concept of the outcome and the model of approach to take. This is essential if the teachers are going to utilize one another's strengths as resources and the program is to last over the long term. High quality dual language programs begin in early childhood, ideally before ages 4-6 years. Once faculties decide upon the model they will target and realize the potential resources available in their colleagues and community, access to the next essential component becomes a logical step.

Cultural Aspects

Inclusion of the cultural aspects of any language represented in the program is essential. Oftentimes, the cultural aspects associated with English speaking cultures is so well integrated into the accepted curriculum that students don't recognize them. Often English-speaking adults say they have no culture. This article, however, addresses programs concerned with the cultural aspects of the minority languages in the program.

Several programs exhibit creative efforts toward including curricular requirements and extra curricular offerings of cultural experiences associated with the languages in the program. Different schools with dual language programs include classes in cultural dances, martial arts and traditional food preparation and serving practices (Lucido et al., 2000). Integrated curriculum efforts involve students in holiday traditions, active research on the cultures of their classroom in a targeted, high quality collection of artifacts, school visitors from the cultural community and regular visits scheduled for children, teachers and parents to the countries and communities where these languages are spoken. Some schools include natives of these countries in the faculty as teachers of the cultural classes to facilitate cultural aspects in the curriculum from an authentic perspective. Creating a format for them to teach their cultural practices has an empowering effect for parents as well as supporting the students in our dual language program (Montague, 1999).

As faculties develop new dual language programs, agree upon the common model and develop meta-cultural awareness, oftentimes they become very enthusiastic. For the program to last, however, it needs to be phased in over time.

Phasing in for Success

Some dual language programs that began with great enthusiasm or as the result of an inspiring administrator experience problems over time. If programs are started too widely, teachers can become overworked while students reach frustration and parents begin to lose hope in the model. At such times, the staff and administration could re-examine some of these essential components.

Inappropriate dual language settings are sometimes created if a school does not phase in the program but opens the program across the grades simultaneously, expecting a fifth grade teacher to be able to deliver half of the curriculum in Spanish to a monolingual English speaker, for example. This can also occur if the administrator allows older monolingual English speakers into upper grades who have not built

an academic conceptual base in any language other than English. In the light of the need for facilitating good instruction for second language learners in addition to the country's need for multilingual employees, the loss of any dual language program for any reason is a travesty.

By gradually phasing in the new dual language program, faculty and administrators assure success in a myriad of ways. Gradual phasing in of a program takes different approaches. Some schools set aside the first year for research. Faculty can spend the first year with community members, parents and administrators as a team. Team members study the available research and meet regularly to discuss all aspects of present and proposed models. Administrators at these schools plan regular staff meetings and research days for teachers and parents to learn about the languages and cultures in their programs. Other teachers regularly engage in opportunities together to travel and to observe dual language programs with administrators and parents.

For many programs, implementation begins in one grade during the first year while faculty research groups continue working to learn the very best of current theory and practice in the field. Either research is examined concurrent with implementation or some kind of summer workshop training takes place on these campuses. Some administrators facilitate both types of experiences for their faculty. In these schools, the first year of implementation begins at the earliest grade available at the school, occasionally in a strand of one or two classrooms at that grade. For example, in a school with four kindergarten classes, two of them provide a Dual Language program. Therefore, the preschool age students begin their school experience in the dual language setting.

After the first year of implementation, these young students move to the next grade and their former classrooms continue with a new group of dual language students. Year two at these schools then includes two grades or strands within grade levels that offer the dual language program as the kindergarteners move into first grade, for example. Subsequent years see an increase of implementation until the school offers a complete strand or school-wide focus of good dual language bilingual education.

Having a program with a gradual phase-in allows staff to identify problems as they occur in a small setting and prevent their future occurrence in later grades. Issues such as language separation, key community resources, teacher expertise and student comfort levels in each language emerge and can be better addressed in future years of the program. Gradual implementation facilitates continued research by the dual language team for additional time, as they are able to see the program begin in their school with their families. This facilitates the creation of a dual language program that keeps students from the local community at the center of curriculum development. High quality dual language programs reflect the communities of children who are served by the program when these are the children at the center of curriculum planning.

Many dual language programs are implemented by professionals who demonstrate a personal expertise in the home cultures and particular family aspects of the students at their school (Lucido et al., 2000). This personal knowledge is the direct result of a faculty conducting targeted team study of their own students as they plan and develop their curriculum. If the students remain at the center of program planning, a high success can be assured.

High Quality Materials

Programs that have been successful for some time include books and other literacy materials in each language that are professionally produced and written by native speakers of the language. Some schools have classrooms where teachers use translated, hand-made books in Spanish while also using professionally produced books in English. This practice sends a very clear message to everyone regarding

the value placed on each language at that school (Montague, 1999). Much of what children learn about language and cultural status is learned at the implicit level. Maintaining high standards for both languages of the program is something that new dual language teams need to be highly conscious of at every stage from planning to implementation to funding for materials.

Krashen (1996, 1999) admonishes all of us in the field to either implement high quality programs or refrain from calling anything less than the best of programs "Bilingual Education.". Students in dual language programs clearly deserve the very highest quality education available; of course this includes literacy materials.

Long Term Commitment

High quality dual language programs include highly enthusiastic faculty members committed to the program enough to pursue training and current knowledge of the best practices available for their students. In some schools, the administrator participates in dual language training along with the faculty and various community members. Faculty members at these schools are able to believe in the long-term success of their dual language program, inspired by the commitment their administrator demonstrates.

Many schools with successful dual language programs request similar commitment from the parent community. If parents pull their children out of the program in intermediate grades, the program can dwindle to an overly small population. This greatly limits the language models available to the students who remain. In addition, school officials and community members are not able to see the program come to full fruition, producing older children who are highly bilingual and biliterate. These students can serve as natural recruiters for good dual language programs as parents and community members see them demonstrate ease moving between two languages.

Dual language magnet schools are able to ask parents for a commitment of time to help in various capacities (Montague, 1999; Lucido et al., 2000). Once the school faculty can depend upon a cadre of dedicated parents with common language goals for the children, the potential of essential aspects of the program can increase exponentially.

In schools where parents are highly committed to reflecting their culture in what they consider to be their schools, they bond on a friendship level and improve the program with their multiple talents (Lucido et al., 2000). When parents and students are valued and the culture of the children is clearly included, the anxiety level is lowered. and all learning in the classroom is enhanced (Krashen, 1999).

Administrative Support

The administrator is usually the key to success or failure of any program at the school. This is particularly true with dual language programs. Some administrators initiate the program and inspire their faculty members and communities. These administrators facilitate training by bringing experts in to the school to work with the dual language team or facilitate grant writing for teachers and parents to travel to the native countries of each language in the program.

Other administrators value their dual language programs highly enough to reserve positions in the program solely for teachers who are pursuing certification in bilingual education. A teacher who is bilingual is not at all the same teacher as one who is certified in bilingual education and understands the affective, linguistic and cognitive aspects of language learning. This difference can be seen across the years of a program as children manifest bilingual capabilities throughout different curriculum areas. A good administrator can reach far into the future of children with a clear vision and a committed faculty.

Second Language Elicitation

In many classrooms across the country, teachers who are not trained in Bilingual Education ask Spanish dominant speakers to perform academically in English before they are competent with that level of English proficiency. These teachers are unaware of the cognitive and social implications this situation creates by stigmatizing language performance in the classroom (Cummins, 1984).

Cognitive transfer occurs naturally with good language teaching. This means that English will reach the productive level for minority language speakers at a natural rate commensurate with the child's social needs, cognitive understanding and language competence (Lessow-Hurley, 2005; Perez, 2004; Soltero, 2004). Through cognitive transfer theory, (Cummins, 1984) one can understand that children learn to read once and can transfer that knowledge across languages once the concept has been learned (Perez, 2004). This is true when learning to read, complete mathematical equations, ride a bike, navigate communication in the cafeteria, and a myriad of other examples of learning needs. In light of this understanding, to ask a child to perform in English in the presence of English dominant peers before cognitive transfer has fully occurred can greatly stigmatize that child in front of peers in addition to stigmatizing language production for the child.

However, the sociopolitical implications of this situation shift dramatically when one considers elicitation of the minority language from English dominant speakers. For these children, performing in the new language in the presence of peers carries different implications. English is often seen as the language of power in U.S. society and sometimes in the classroom as well. Any effort at production beyond the dominant language of English by native English speakers is valued and not expected by most people. Therefore, when an English speaker uses his new language in the presence of peers, status actually increases.

Consider what happens when a Spanish dominant speaker attempts English use before her peers and receives jeers and lowered status if her efforts are broken or incorrect. In addition to this difference, the minority language actually gains validation in the eyes of peers when the English dominant speakers are expected to master the minority language. The ironic truth of this phenomenon can be made to benefit good dual language programs.

Many schools use creative elicitation efforts at various levels embedded in the program. Some schools facilitate children's writing and performance in dramatic and cultural arts presentations or produce videos for incoming students and parents. Other schools require integrated cooperative learning with heterogeneous language grouping across curriculum areas. With this type of planned elicitation, children have the time to prepare and practice and ultimately perform in their second language. Spanish speakers use English while English speakers use Spanish for these elicitation activities. Such efforts set the children up for success in their new language, further validating the learners and the program for everyone.

Secondary School Commitment

Very often, high quality dual language programs produce fully bilingual, biliterate students who have studied in two languages for five to six years only to have the option of taking Spanish I, II or III at the next grade level. By the time these children reach high school, they have taken all of the classes in Spanish available to them and have actually lost some of their bilingual abilities. Language is much like muscle tone: one either uses it or loses it. This occurs quickly.

Conclusion

The cognitive benefits of bilingualism last a lifetime. This can be seen as bilingual children perform higher than monolingual peers in curriculum areas that require problem solving such as in math and science. The cognitive flexibility demonstrated by bilingual children moving between two languages is easily put to good use when children attempt a math problem or science experiment from various perspectives. If the benefits of bilingualism can be extended across the curriculum into the secondary level all the way through to high school graduation, a great benefit indeed will be attained. If our country´s greatest unexplored resource of cultural and language difference were tapped to benefit the future generations, dual language and language immersion programs can be expanded across many communities and impact the common future. The creation of a fully bilingual, biliterate generation that can investigate expanded levels of potential in the global society is a good target goal for everyone. With good planning, careful consideration and committed involvement, this is one goal for all to reach toward with confidence.

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Explorando las matemáticas…relación entre lenguaje, instrucción y logros en matemáticas en programas de Doble Inmersión

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Resumen

Esta investigación explora la relación entre el dominio en un idioma, tipo de programa y el aprovechamiento en la materia de matemáticas por estudiantes hispanos matriculados en un programa de Doble Inmersión. El programa comenzó hace nueve años como resultado de una colaboración entre un distrito escolar, una universidad privada y una fundación corporativa. Resultados de análisis preliminares parecen indicar que el dominio inicial no afecta el aprovechamiento académico ni en inglés ni en español. Asimismo, al comparar los resultados del programa tradicional (inglés solamente) el análisis arroja evidencia de que el modelo bilingüe empleado parece influir sobre los logros alcanzados por estudiantes matriculados en este programa.

Introducción

La compleja relación entre la competencia lingüística y el aprovechamiento en matemáticas por estudiantes que no dominan el inglés académico ha sido documentada por varios investigadores (Ovando, Collier & Combs, 2003; Ramírez Corpus Mather & Chiodo; 1994). Normalmente se reportan los resultados obtenidos en términos de las deficiencias de estos estudiantes que no dominan el idioma de instrucción.

Los expertos coinciden en su consideración de la importancia de las matemáticas y el razonamiento matemático entre los estudiantes de inglés limitado, particularmente aquellos de ascendencia hispana en los Estados Unidos. Aunque la creciente influencia hispana en los centros urbanos de la nación ha sido documentada extensamente, este imperativo demográfico se acrecienta cada vez más en ciertos estados, entre ellos el estado de Texas. En este estado que comparte sus límites fronterizos con México, se documentan cerca de un millón de estudiantes matriculados en sus planteles que no dominan el idioma de instrucción, el inglés. Recientes datos reportados por el distrito escolar de Houston (HISD), el más populoso del estado, reporta que aproximadamente el 60% de su matrícula es de origen hispano y aproximadamente 60,000 de sus 238,000 alumnos se clasifican limitados en sus destrezas académicas en inglés (HISD Facts & Figures, 2005).

Las disparidades en la enseñanza y el aprendizaje de las matemáticas dentro de esta población han sido documentadas por el Consejo Nacional de la Enseñanza de Matemáticas (NCTM, por sus siglas en inglés), entre otros, quienes afirman también que existen marcadas diferencias entre el desempeño de estudiantes mayoritarios angloparlantes y los estudiantes hispanos (NCTM, 2000). Por ejemplo, en reportes emitidos por la Evaluación Nacional del Progreso Educativo (NAEP, por sus siglas en inglés) en el año 1994, se encontró que entre estudiantes de cuarto grado, menos del 50% de los hispanos demostraron un desempeño adecuado en las destrezas básicas de matemáticas mientras que el 80% de estudiantes mayoritarios de angloparlantes demostraron éxito en cálculos y destrezas matemáticas a este nivel (NAEP, 1994).

Reformas iniciadas por organizaciones tales como la NCTM reiteran la importancia de esta meta y reconocen el potencial impacto que tienen las limitaciones en el idioma en crear barreras en el aprendizaje de las matemáticas (NCTM, 2000; Ovando, Collier & Combs, 2003). Los expertos en el área de las matemáticas reconocen la estrecha relación entre el desarrollo del lenguaje académico y las destrezas que permiten llevar a cabo el razonamiento matemático. O sea, que el creer que las matemáticas emplean un idioma universal, y por lo tanto, los conceptos matemáticos están al alcance de todos, no importa cuales sean sus destrezas lingüísticas, es un mito, según el actual pensamiento al respecto expresado por expertos (Stigler& Hiebert, 2004; Kang, 1995; Moschkovich, 2004**).**

La importancia del tipo de instrucción y programa escolar que se les ofrece a estudiantes de inglés limitado es bien reconocida entre los expertos. A pesar de que la mayoría de los estudiantes hispanohablantes que no dominan el inglés se encuentran en programas bilingües de transición, o sea, programas que tienen como meta la transición al programa en inglés, varias investigaciones recientes (Thomas & Collier, 2002) reportan que los alumnos bilingües que cursan estudios en programas de Doble Inmersión no sólo llegan a dominar ambos idiomas de instrucción, sino que también obtienen altos logros en pruebas de aprovechamiento académico. Estos programas se caracterizan por una composición balanceada entre estudiantes hispanohablantes y alumnos cuyo idioma materno es el inglés al iniciar su programa escolar. Otro elemento esencial de estos programas es la enseñanza de materias de contenido, como lo son las matemáticas, a través del idioma minoritario, a pesar que esta instrucción aumenta gradualmente hasta llegar al 50% en el grado quinto de primaria (Christian, 1994).

Descripción y Objetivos Investigativos

Este artículo reporta los resultados de una investigación longitudinal cuya meta fue el estudio de la relación entre el dominio lingüístico, el idioma de enseñanza, y los resultados en pruebas de aprovechamiento matemático suministradas en ambos idiomas (inglés y español) a estudiantes en un programa de Doble Inmersión. Estos estudiantes comenzaron sus estudios en el Centro Comunitario Primario al nivel de Kindergarten y continúan al nivel de octavo grado. A su vez, se examinan las posibles razones por las cuales este programa reporta altos logros matemáticos tanto en español como en inglés. Igualmente, se discute la relación entre programa de instrucción, métodos empleados por los profesores y el desarrollo del registro matemático en ambos idiomas reportando los resultados de dos observaciones informales en salones donde se emplea el método de Doble Inmersión.

El programa bajo consideración está ubicado en el Centro Comunitario Primario donde fue iniciado en el año 1996 como un segmento del programa tradicional primario que ofrece dicha escuela. Este programa de Doble Inmersión se inició tras un acuerdo entre el distrito escolar, una universidad de la localidad y una fundación sin fines de lucro con el propósito de ofrecer un programa de enriquecimiento lingüístico y académico a estudiantes hispanos de bajos recursos y en riesgo de fracaso escolar. Actualmente, este programa se ofrece a nivel secundario (sexto al octavo), ya que éste fue extendido a un plantel secundario de la vecindad con el propósito de continuar la instrucción en dos idiomas hasta el nivel de preparatoria (Torres-Karna & de Kanter, 2004).

Marco Teórico

Al examinar algunos datos demográficos basados en proyecciones obtenidas por el censo oficial de los Estados Unidos, se hacen evidentes los diferentes tipos de programas que fueron creados con tal de cumplir con los reglamentos y leyes impuestos por la promulgación del decreto bilingüe oficial, las bases teóricas que sustentan dichos programas, y los resultados de investigaciones longitudinales que se han llevado a cabo.

Sin embargo, el objetivo principal al implementar un programa de instrucción, no debe limitarse al desarrollo de destrezas bilingües, sino también el poder maximizar los logros académicos por alumnos hispanos matriculados en dichos programas y, más importante, el llegar a desarrollar las destrezas del lenguaje académico requeridas por los alumnos para lograr éxito académico (Cummins, 1986). ¿Se consideran iguales todos los programas? Según nos indica el investigador galés, Colin Baker (2001), algunos programas pueden ser clasificados como débiles, mientras que otros se tildan de fuertes, según los logros obtenidos por los alumnos y su éxito al lograr cerrar la brecha entre el rendimiento académico de los alumnos angloparlantes y los estudiantes con limitaciones en sus destrezas lingüísticas (Baker, 2001; Collier & Thomas, 2004).

Entre los programas llamados “fuertes”, los logros positivos reportados por programas de Doble Inmersión han sido extensamente documentados (Collier & Thomas, 2004; Lindholm, 2000). Según investigaciones recientes, estos programas logran cerrar la brecha, y en algunos casos, mejorar el aprovechamiento académico obtenido tanto por estudiantes mayoritarios como también por las minorías lingüísticas que participan (Thomas & Collier, 2002). En programas de Doble Inmersión la educación se imparte en dos idiomas - el idioma mayoritario y el de la minoría lingüística, en este caso, el español, a partir de los grados pre-escolares y se espera que los alumnos adquieran destrezas académicas en ambos idiomas (Lindholm, 2000).

A pesar de la abundancia de investigaciones recientes que examinan los logros por estudiantes en programas de Doble Inmersión, hasta el momento existe una escasez de investigaciones que exploran la enseñanza de las matemáticas a estudiantes aprendiendo a través de un segundo idioma como medio de instrucción. Aunque existen investigaciones que tienen como objetivo la observación de la enseñanza de procesos matemáticos, no abundan las comparaciones entre los diferentes tipos de instrucción y los

métodos empleados por los profesores en sus respectivos programas.

En cuanto a la enseñanza de las matemáticas a estudiantes bilingües, una investigación llevada a cabo por Tamamaki (1993) reporta que los estudiantes bilingües prefieren hacer los cálculos matemáticos en su primer idioma y que éstos tienden a resolver operaciones más rápidamente en el idioma en que estos procedimientos fueron aprendidos. A su vez, Marsh & Maki (1976) empleando una muestra de individuos bilingües compararon la facilidad y velocidad al hacer cálculos matemáticos. En base a los resultados, los autores reportan que los bilingües tienden a resolver operaciones aritméticas más fácilmente en su idioma materno, o en el idioma en el que aprendieron estas destrezas. Sin embargo, estos investigadores descubrieron que dicha facilidad no es permanente ya que puede ser alterada al cursar estudios matemáticos en otro idioma (Marsh & Maki, 1976).

Asimismo, algunos estudios realizados en el campo de las matemáticas revelan la importancia de la comunicación entre estudiantes y estudiantes y maestro/a al resolver problemas de razonamiento (Brenner, 1998; Moschkovich, 2004). El énfasis que se pone en la comunicación entre los alumnos y el uso de grupos pequeños deriva de un consenso entre los expertos de que el aprendizaje en matemáticas resulta más efectivo dentro de un contexto social. En un estudio realizado por Brenner (1998) se encontró que el uso de grupos pequeños facilita la discusión a un nivel de complejidad más alto entre estudiantes que no dominan el inglés ya que al integrar estos estudiantes en situaciones de 'grupo entero', estos se cohíben y rehúsan participar dada su baja competencia en el idioma de instrucción.

Igualmente, Moschkovich (2004), desde la perspectiva del análisis discursivo comparó a tres tipos de acercamientos empleados al enseñar a razonar matemáticamente en clases bilingües. Estos estudios basados en el marco filosófico del constuctivismo han demostrado la importancia de incorporar la enseñanza del registro académico además de las habilidades básicas de cómputo y razonamiento (Moschkovich, 2004).

Muchos de estos estudios sugieren que la metodología empleada por el maestro dentro de un programa instruccional influye en el aprovechamiento académico de sus estudiantes; sin embargo, hasta el momento no se ha explorado la relación entre un programa bilingüe específico y los logros en el razonamiento matemático de los alumnos bilingües. El programa bajo consideración en esta investigación cumple con los requisitos de los llamados programas fuertes. Los resultados de las pruebas administradas a sus estudiantes arrojan evidencia de que las estrategias de instrucción empleadas por maestros en este programa de Doble Inmersión tienen un efecto positivo. Según expertos como Ovando, Collier & Combs (2003), los métodos que más favorecen el desarrollo de razonamiento matemático son, entre otros, el desarrollo de la comunicación matemática, el uso de manipulables, grupos cooperativos, negociación de significados en el segundo idioma entre maestro y estudiantes y el desarrollo de vocabulario académico. Ya que la instrucción en los programas de Doble Inmersión se basa en el empleo de métodos que integran lenguaje y contenido en un contexto significativo (Ovando, Collier & Combs, 2003; Lindholm, 2000), esta investigación pretende explorar el potencial beneficio de dicho programa para ambos grupos lingüísticos que tradicionalmente participan en ellos.

Descripción de la Investigación

Muestra

La población estudiada incluye alumnos de escuela primaria cursando estudios en programas de Doble Inmersión, en un ambiente donde predomina el español como segunda lengua, específicamente en el sudoeste de los Estados Unidos. La muestra estudiada consta de cuatro grupos matriculados en el Centro Comunitario Primario entre los grados Kindergarten al quinto de primaria. También se estableció un acuerdo de colaboración con la escuela secundaria de la vecindad para extender el programa hasta el octavo grado. Por consiguiente, se han incluido los resultados de pruebas hasta el grado séptimo de secundaria. Aunque la investigación no tiene un diseño experimental, desde el principio del programa se ha incluido un grupo correspondiente matriculado en el programa llamado tradicional, o sea donde la instrucción se imparte estrictamente en inglés. Este grupo ha sido utilizado como grupo de referencia o comparación.

El Centro Comunitario Primario, localizado en una ciudad del sudoeste de los Estados Unidos está ubicado en una zona central de la ciudad caracterizada por una población que se ha transformado de un nivel socioeconómico bajo, predominantemente hispano, a uno de clase media alta mayormente anglohablante. Aunque la zona se encuentra en desarrollo, la matrícula ha permanecido constante, con un aumento gradual en la representación anglo. Esto se ha notado en los últimos años ya que la escuela ha sido designada un centro oficial para programas de Doble Inmersión ("tipo magnet"). Por consiguiente, el 84% del programa instruccional de dicho plantel es ahora de Doble Inmersión. Actualmente, la escuela sólo le ofrece un programa tradicional al 16% de sus alumnos, del 55% cuando se inició el programa en 1996.

Centro Comunitario Primario

Perfil del Programa

1996-2005

1996-1997 **Grado**	**Programa bilingüe	**2004-2005** **Kinder-5to**	*Programa de ingles
Inmersión	5%	Inmersión	84%
PBT**	40%	PBT	0%
Tradicional*	55%	Tradicional	16%
Plantel bilingüe	40%	Plantel bilingüe	80%

Preguntas de Investigación

Las preguntas que se investigaron en este estudio fueron las siguientes:

¿Qué relación existe entre el dominio lingüístico de alumnos matriculados en programas de Doble Inmersión y los logros en pruebas nacionales de matemáticas?

¿Qué relación existe entre tipo de programa bilingüe y el método de enseñanza y los logros matemáticos obtenidos por alumnos matriculados en programas tradicionales y en programas de Doble Inmersión?

Las preguntas ante-mencionadas fueron exploradas a través de las siguientes hipótesis:

Existe una relación entre el dominio inicial del inglés y el aprovechamiento académico en pruebas de matemáticas suministradas en inglés.

Existe una relación entre el dominio inicial del español y el aprovechamiento académico en pruebas de matemáticas suministradas en español.

Existe una relación entre tipo de programa y los resultados obtenido en pruebas de matemáticas tanto en el idioma de instrucción como en el segundo idioma.

Instrumentos de Evaluación

Se suministraron una serie de instrumentos con el propósito de medir las destrezas lingüísticas iniciales, las habilidades académicas en ambos idiomas, el desarrollo cognitivo y el rendimiento académico en matemáticas, lectura, y lenguaje. Además, cada grupo ha sido examinado con la prueba de criterio estatal suministrada por el estado de Texas (Texas Assessment of Knowledge and Skills:TAKS, por sus siglas en inglés). Esta se suministra en el idioma de instrucción de los alumnos, a partir del tercer grado.

La prueba utilizada para medir las destrezas lingüísticas iniciales fue la prueba ***LAS (Language Assessment Scales).*** Resultados lingüísticos subsiguientes se obtuvieron de la prueba ***Woodcock-Muñoz Language Survey*** suministradas cada año en español y en inglés, aunque no se emplearon estos resultados en el presente estudio. La variable dependiente (logros matemáticos en inglés y español) se obtuvo de los resultados obtenidos de la prueba nacional estandardizada ***TerraNova Assessment Series*** y de la prueba correspondiente en español***, el Supera Assessment Series***. A pesar de que la investigación y el análisis de la data continúan, se pueden soslayar algunos resultados preliminares del análisis que se llevó a cabo.

Procedimientos

Análisis Cuantitativo:

Para hacer las pruebas a las hipótesis, se ejecutaron diversos análisis paramétricos. A su vez, para explorar las relaciones estadísticas entre las variables, se produjo una matriz de correlaciones. Se produjo también un análisis de varianza unidireccional con tal de llevar a cabo las pruebas a las hipótesis postuladas. También se ejecutó una regresión múltiple para determinar las variables que predicen un cambio en la variable dependiente: aprovechamiento matemático en ambos idiomas. Para propósitos del presente análisis, las puntuaciones brutas fueron transformadas a la escala NCE, similar al percentil, pero indicando intervalos iguales. Para todas las pruebas inferenciales, se estableció un nivel alpha de probabilidad de menos de .05.

Observaciones Informales y Diseño del Programa Estudiado:

Con tal de determinar los métodos empleados por los maestros en el Centro Comunitario Primario, la investigadora entrevistó a la coordinadora del programa, y a su vez, se observaron dos clases de matemáticas al nivel de kindergarten y de cuarto grado con tal de establecer la relación entre los métodos de enseñanza y el aprovechamiento académico de los estudiantes en el programa.

Resultados y Conclusiones

El análisis de varianza demuestra que los promedios obtenidos en las pruebas de aprovechamiento de matemáticas suministradas en inglés no difieren significativamente cuando se emplea dominio en inglés como variable dependiente. Ya que el valor alpha para el análisis de varianza fue mayor a .01, se rechaza la hipótesis alterna. Se puede concluir que la participación en un programa (ya sea tradicional en inglés, o de Doble Inmersión, en español, no tiene un efecto significativo en las habilidades matemáticas cuando la prueba se suministra en inglés.

Por otra parte, el análisis de varianza demuestra que la variable dominio inicial en español si tiene un efecto significativo al administrar las pruebas de matemáticas en español, aunque no se logren esos resultados en inglés. Lo que demuestra que los alumnos matriculados en programas de Doble Inmersión mantienen sus habilidades matemáticas en español y logran obtener altas puntuaciones en inglés, no importa su dominio inicial en ese idioma. Estos logros son constantes, no importa el dominio inicial demostrado por los alumnos. O sea, para los estudiantes hispanohablantes en programas de Doble Inmersión, el factor Idioma Inicial no parece influir sobre los resultados obtenidos en las pruebas matemáticas, no importa en

que idioma se suministre la prueba.

En cuanto al programa tradicional donde los alumnos aprenden a través del inglés, no importa su dominio inicial en el idioma de instrucción, la variable Idioma Inicial, no parece tener ninguna influencia sobre su aprovechamiento matemático cuando toman las pruebas en inglés, aunque si cuando estos las toman en español.

Resultado de promedios de logros matemáticos empleando pruebas normativas (NCE)

SUPERA (español)- TERRA NOVA (inglés) programa Tradicional	**1999**	**2003**	**2004**
Matemáticas inglés ***TERRA NOVA***	**46.9**	**57.0**	**54.6**
Matemáticas español ***SUPERA***	**15.4**	**34.2**	**26.3**
Programa:Inmersión **N 73**	**1999**		**2004**
Matemáticas inglés ***TERRA NOVA***	**39.3**	**50.5**	**49.31**
Matemáticas español ***SUPERA***	**20.1**	**50.7**	**54.6**

Correlaciones entre Dominio Inicial en Español e Inglés y Pruebas Normativas

=.001**

	INIT ENG	**SUPM2004**	**TERRM04**
INIT SPAN	**.56****	**.14 (.146)**	**.15(.074)**
INIT ENG	**1**	**-31****	**.34****

Análisis de Varianza y Regresión Múltiple: Var. Dep. SUPMAT.

Modelo	Suma de cuadrados	df	Promedio de cuadrados	F	Sign.
Regresión	6281.2	2	3140.63	10.0	.001
Residual	30668.8	98	312.9		
Total	36950.1	100			

Igualmente, dada la alta correlación positiva (Pearson r) entre el promedio obtenido en la prueba en español Supera 04 y el promedio obtenido en los resultados de la prueba en inglés, Terra Nova 04, se estima que aquellos alumnos que logran buenos resultados en el idioma inglés, también logran resolver problemas matemáticos en español.

Discusión

Al examinar el marco teórico que enmarca el tema estudiado, o sea, la relación entre las habilidades matemáticas y el dominio del idioma de instrucción, se establece una fuerte conexión entre idioma y pensamiento. O sea, que las habilidades de razonamiento matemático dependen de una capacidad lingüística lo suficientemente desarrollada para permitir la comunicación y expresión de las destrezas aprendidas. Este hecho ha sido señalado por expertos, tales como Kang (1995) y Moschkovich (2004) al afirmar que los maestros necesitan fomentar las habilidades de comunicación y desarrollar el discurso académico en la materia de matemáticas. Por esa razón, se examinó la relación entre dominio lingüístico, programa empleado y resultados en pruebas de aprovechamiento matemático en un programa de composición integrada donde se cuenta con estudiantes que dominan el inglés al iniciar el programa, a la vez que estudiantes mayormente hispano- hablantes. También, la escuela estudiada cuenta con un programa tradicional con instrucción completamente en el idioma inglés.

En cuanto a la metodología empleada, se pudo comparar el tipo de instrucción recibida por los estudiantes en el área de matemáticas ya que los maestros reciben el mismo tipo de desarrollo profesional por profesores de la facultad de matemáticas. Al corroborar dichos métodos, se encontró que los maestros emplean acercamientos comunicativos, donde se desarrollan el vocabulario y registro matemático de los estudiantes. Al comparar los resultados cuantitativos, el análisis de los datos parece indicar que el tipo de programa empleado, y no, el dominio inicial en el idioma de enseñanza tiene una fuerte influencia sobre los resultados obtenidos en las pruebas de matemáticas suministradas en un idioma o el otro. Los altos logros obtenidos por los estudiantes en el programa de Doble Inmersión y las correlaciones positivas entre los resultados obtenidos en español y los resultados en inglés, parecen señalar que el programa de Doble Inmersión desarrolla altos niveles de competencia lingüística académica, que apoya los resultados reportados por Thomas y Collier (2004) y otros investigadores que han comparado los modelos bilingües ofrecidos por los distritos escolares en el estado de Texas.

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Science Concept Learning in a Dual Language Setting

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Abstract

The following study was designed to add to our understanding of science concept learning in a bilingual setting using a student-centered, inquiry- based curriculum. Ten early childhood classrooms in the Socorro School District near El Paso, Texas, participated in the research. Children were learning science through an interactive curriculum taught in a two-way dual language program. Data gathered from student interviews, classroom observations, student assessments, and teacher interviews indicate that the children were understanding and retaining science content, even though only half the curriculum was presented in their home language. The students were able to recall the objectives of the curriculum unit and orally describe the hands-on activity they had participated in from one to two years in the past. The research provides evidence to suggest that science content learning is not compromised for second language learners in a dual language setting when they experience an interactive, constructivist science curriculum.

Introduction

This case study describes an elementary science program in a bilingual community in west Texas. All of the children in the ten primary classrooms in the study were learning all content in Spanish and English through the two-way dual language approach. English-speaking teachers and Spanish-speaking teachers teamed in pairs so that the children experienced alternating days of learning in English or Spanish. All of the children in the ten classrooms were also involved in an interactive, constructivist and hands-on science curriculum. The interactive science curriculum and the consistent use of two languages provided a unique arena to explore the content development and content retention of children who were learning science half of the time in a language that is not their home language.

As the United States becomes more and more multilingual, it is particularly important that we search for programs that provide quality education for students whose home language is other than English. According to the National Clearinghouse for Bilingual Education (2002), approximately 9.3 percent of the total public school student enrollment in school year 1999-2000 was learning English as a second language. This number was an increase of more than 27 percent from the number reported two years previously. In the majority of these multilingual communities, the home language is Spanish, and the achievement gap between Hispanic students and white students is increasing. Jaekyung Lee (2002) analyzed multiple achievement-gap measures, including National Assessment of Educational Progress scores, SAT scores, poverty, and high school dropout rates. Lee found that although the achievement gaps were decreasing in the 1980s and early 1990s, they have been increasing over the past few years, and the gaps remain substantially large. The dropout rate for Hispanic students has consistently been four times greater than for White students.

Inequities exist especially in science education for Hispanic students. In Texas, Hispanics represent 40 percent of the population, and this number is higher for the school-age population. On the 1996 National Assessment of Education Progress, 45 percent of Texas eighth graders were below the basic level in science achievement. Of the Hispanic eighth graders in Texas, 67 percent were below the basic level in science achievement (O'Sullivan, Reese & Mazzeo, 1997). On the Texas State Science and Engineering Fair web site the 1998 winners are listed. Of the 167 winners, only 18 had Spanish last names. Spanish last names do not always identify Hispanic students. However, this is a strong indication that only a small percentage of the winners are Hispanic.

Dual Language Bilingual Programs

A person develops self worth through using his/her own voice. Bilingual programs that allow the students to participate by using the home language value the child and his/her language. Cummins (1996) advocates that bilingualism and biliteracy be educational goals for all students and that bilingual instruction emphasize developing literacy in the minority language. He states that there is no one prescribed model for biliteracy. Becoming successfully bilingual is a very complex process requiring much time. Most studies show that it takes from two to eight years, with most students becoming fluent in a second language within four to five years (Collier, 1987).

There are several kinds of bilingual programs in schools in the United States. One is a transitional model, designed to move a learner from the first language into English. Other programs are enrichment programs, designed to allow children to learn academic content in the home language. Dual language programs provide content area instruction and language development in English and the other (target) language. In these classrooms, students learn language primarily through content. Two-way dual language programs integrate learners whose native language is English with learners whose native language is other than English in the two language instruction program.

Lindholm's (1990) research identifies the following factors essential for successful dual language programs. Primarily, students should participate for a minimum of four to six years. Quality instruction must be provided over traditional fact-based delivery methods to interest students and lead to success. Students must have many opportunities to dialogue together and learn in cooperative settings. There should be a balance of English-dominant students and target-language learners in the classroom, and the instruction should be balanced between the two languages. Finally, the school should have effective strategies, such as family involvement and qualified staff. Torres-Guzmán (2002) states that dual language programs should follow consistent and clear linguistic, sociocultural, and educational policies including a variety of features. Features of the linguistic policies include strict language separation, equality in language distributions, language taught through content, and whole-language instruction. Parental involvement, appreciation of cultural diversity, and development of self-esteem are features of the sociocultural policies. The pedagogy should focus on academic achievement for all children, team-teaching, thematic units, and teachers as monolingual models. The high-interest content and interactive and hands-on aspects of a strong constructivist curriculum, such as the science curriculum in this study, should facilitate this language development.

Interactive, Constructivist Science Curriculum

Much research is available to show that children learn science better through constructivist, interactive science instruction (Bredderman, 1983; Kyle, Bonnstetter, McCloskey, & Fults, 1988; Shamansky, Hedges & Woodworth, 1990; Yager, 1993). In a constructivist science curriculum, the students are interacting with the natural or designed world in a social context to construct new understandings. Constructivist learning is far removed from the traditional method, where the teacher or book delivers fact-based information to children who are passive recipients working in isolation. Good science learning experiences improve learning in other areas also. A study by Klentschy, Garrison, and Amaral (1999) shows significant improvement in writing as well as science content by children involved in a constructivist, interactive science curriculum.

When a science education program mirrors natural science learning experiences, the learning is rewarding, comfortable, and enjoyable. Humans are inquisitive by nature and are attracted by new ideas. We always want to know more. This skill has helped us survive as a species. This inquisitiveness is so strong in children that we often must protect them from their inquiries. We, and especially the youngest of our species, are natural scientists, ready to explore, ask questions, investigate, observe, and wonder about the world around us. Kovalik (1997) defines content that comes from the natural world around us as meaningful content. Students can access this content because it is age-appropriate. It is complex enough that the brain struggles to seek patterns and create meaning. It is related to the learner's prior experiences and is useful to the learner. Kovalik (1997) further explains that there is little need for external rewards because the learning experience is full of discovery and excitement. The human brain is programmed to explore the natural world, and it rewards itself when the learning is rich in discovery and exploration.

The teaching of science should be based on this natural tendency in children to explore their world. As teachers or family members, we guide them into more formal science skills. We help them learn to organize their questions and information gathering so they gain a deeper and more thorough understanding of a concept. For example, condensation on the outside of a cold glass appears to be water leaking out through the glass. Providing more investigations with empty cold glasses, mirrors, and teakettles leads the students to construct better explanations. We help them organize their information into charts, tables, and graphs. As their development levels grow, we begin to lead them to understand how to design and interpret investigations. We help them analyze the information and communicate what they have learned about the exploration. We provide the opportunities for them to question where these understandings fit in their world and why.

The science curriculum used in the classrooms in this investigation was the Full Option Science Series (FOSS) created by Lawrence Hall of Science (1995). FOSS is one of several science curriculum programs designed in the past few years to assist teachers in implementing an inquiry-based, constructivist science-learning program. This program is a student-centered, hands-on curriculum that provides curriculum guidance, background information for the teacher, and all the materials for classroom implementation**.**

Inherent in the curriculum is a focus on discourse. The FOSS Curriculum Introduction describes its focus on discourse as the tool to lead students to think about their experiences with science materials and peers. "An idea or concept must be synthesized from the innumerable bits of stored information, and that concept must then go through the language center, where it is deconstructed into a string of symbols we call words, and output in a sequence that conveys information--an awesome cognitive process" (p. 7). In this approach, children develop their own understanding through several venues. They manipulate and interact with real or designed world materials. They talk among themselves in pairs or small groups while working through the activities. Whole-class discussion sessions summarize the lesson and share the information from the children's own words. Teachers interact informally with the children as they are working to probe deeper into their thinking. The students also respond formally to written and oral assessments. In this study, published materials were less important in the integrated project than the teachers' focus on discourse, student thought, and student understanding.

Research Design

The following investigation was designed to add information to our understanding about children's science content development and retention in the two-way dual language setting using the interactive science curriculum. This descriptive case study (Leedy & Ormrod, 2005) focused on the question of how science concepts develop and are retained when a constructivist curriculum is delivered half in the home language and half in the target language. The research took place over two years in the ten kindergarten, first- and second-grade dual-language classrooms in Ernesto Serna School in the Socorro District in the El Paso area.

The researchers align with an interpretive paradigm rather than a positivist research paradigm. We have been allowed to explore the programs for two years through classroom observations in the ten classrooms and interviews with the students and teachers. Data were gathered from several resources, as described in Table 1 below. The interviews were very open. We only asked the children to tell us what they remembered about their science from the previous year and the previous semester, and we asked the teachers to provide evidence of whether or not the students had learned the concepts. As a prompt, we showed the children four drawings that were taken from the student handouts, showing children interacting with the science materials.

The interview and observation transcripts were interpreted via the constant comparative method (Glasser & Strauss, 1967) and coded to understand the patterns of thought leading to the development of categories for themes. The themes that emerged related to the specific science concepts or to evidence of language development. These were examined for the specific meanings they have in relation to the case. We attempt to provide an overall portrait with sufficient detail in the report in order to give the reader confidence in the findings and to highlight multiple sources or examples to develop each concept or theme.

Table 1

Research Data Sources

Participants	Information	Sources
Approximately 200 primary age children	Concept development	Classroom observations
	Participation in science curricular activities	
Eight second-grade children who had been in two-way dual language and interactive science during the current and previous year	Concept development	Small group interviews
	Content retention	Individual interviews
		Classroom observations
		Written work
Eight first-grade children who had been in the two-way dual language and interactive science during the current and previous year	Concept development	Small group interviews
	Content retention	Individual interviews
		Classroom observations
Ten teachers who had been teaching the two-way dual language and interactive science for one or two years	Perceptions about content development, content retention, and language acquisition	Small group interviews

Setting

Socorro is a suburban rural community located in far eastern El Paso, Texas. It is the oldest active Roman Catholic parish in the United States and home to a mission founded in 1681, when Spanish and Native American refugees were fleeing the Pueblo Revolt. Today it is one of the fastest growing districts in Texas. Many of the large *maquiladoras* (United States manufacturing plants located in Mexico to take advantage of labor resources) are located just south of Socorro across the Rio Grande in Ciudad Juárez, Chihuahua, Mexico. The population is 90.1 percent Hispanic, 1.28 percent African-American, 0.14 percent Native-American, and 8.14 percent White (Texas Education Agency, online). Sixty-eight percent of the students come from low-income families. Thirty-seven percent receive bilingual education services. The community is a jigsaw of El Pasoans following the urban sprawl to the east, many Mexican immigrant families, unincorporated communities of low-income families living in homes with no interior plumbing on unpaved roads, and one golf-club community of retirees enjoying the desert sun.

The school in this study was using the two-way, dual language approach to bilingual education. The children were taught all content in both languages and were placed in classes with peers of mixed language backgrounds. Some of the children spoke Spanish at home, some English, and some both languages. The teachers worked in pairs and arranged the curriculum so that the content was continuous. For example, the children had Science Lesson 1 in Spanish on Monday from the Spanish-speaking teacher, then Science Lesson 2 in English on Tuesday from the English-speaking teacher, and so on, alternating the lessons each day between their two teachers. The content was not interrupted. The English-speaking teacher did not repeat the lesson from the science lesson in Spanish the day before, but built on that concept. The teachers taught science every day using the FOSS curriculum. The children worked together and talked

together. The peer interactions were designed so that the students would learn together. There was no hierarchy or expert in the learning groups. All of the kindergarten, first-grade, and second-grade classes in the school (ten classrooms) were involved in this dual language, interactive science program. We observed all of the classes.

Participants

In the two-way dual language classrooms in this study, the first-language (L1) Spanish speakers and L1 English speakers were working in groups in the same classrooms. Some of the children were monolingual, and the children's ability to use their target language (L2) varied. Before they entered school, some of the children heard and spoke a second language in extended family settings. Often second-generation Mexican-American children learn English in the home and hear Spanish when they are with other family members who are dominant Spanish speakers. As they enter the two-way dual language program, they hear and begin to use English and Spanish equally. The children's language dominance is determined by the Language Assessment Scale (LAS), an assessment system designed to provide complete information about a student's language proficiency. Children are rated: 1-non-speaker; 2-limited speaker who uses isolated phrases and very simple sentences; 3-limited speaker who uses complete sentences with errors; 4-fluent speaker who uses complete sentences, few errors, and limited vocabulary; and 5-fluent speaker who uses complete sentences with no errors (CTB-Mc Graw-Hill, 2004)).

The second-grade children who participated were rated at the beginning of their second grade year on a LAS Pretest after they had been in the two-way dual language program for two years. Their strengths in the two languages vary, as the chart below shows. The children's names have been changed.

Table 2

Second Graders' LAS Ratings

Name	Pretest English rating	Pretest Spanish rating
Maria	4	1
Alicia	5	2
Roberto	5	3
Jon	1	2
Celia	4	4
Joel	3	5
Ellie	3	5
Melissa	1	5
Jose	1	4

Limitations of the Study

We examined the children's content development and retention of science content over time when involved in an interactive science program in a two-way dual language program. The research does not claim to evaluate the quality of the two-way dual language program at the study site. It is also important to note that the research was not designed to determine the extent of the language development of the children in home or target language. However, there is evidence in the data to indicate that the children in the second-grade had developed new vocabulary and language skills in their second language.

Results

Second Graders Learning Air and Weather

Eight second-grade children were selected for the second-grade group interviews. Four were randomly chosen from the eight English-dominant students and four others were randomly chosen from the eight Spanish-dominant students in Ms. Flores' classroom. We selected every other name on the class roster. The children met with us, four at a time, in a corner of the library. Because we were often in the classes observing the science activities, the children knew us and were comfortable talking with us. This small-group interview format was selected so that children's comments would stimulate each other and focus on the science lessons from the previous months or the previous year. The intent was not to identify an individual child's content retention. We were more interested in determining what concepts, processes, and vocabulary would emerge in a comfortable setting when the children were able to reflect on their earlier science learning. Their language ability (listed above) varied. Four were interviewed in English and four in Spanish, but they were told that they could respond in either language. These children had participated in four complete FOSS curriculum units during the two years.

In the *Air and Weather* curriculum, the students did the following activities designed to build the concepts listed. These activities included:

1) Using syringes and plastic tubes to explore air pressure and compression

2) Adding water to the syringe system and exploring how the air moves the water

3) Making bubbles in water and soap solution and flying the bubbles outside

4) Making and launching parachutes with two different weights

5) Investigating a propeller system

6) Making a balloon rocket

7) Constructing, varying, and flying gliders

8) Designing an air-propelled or air-using device

9) Making a variety of wind catchers

10) Observing and comparing the action of the wind catchers in moving air

The activities took about twelve lessons to complete.

In performing these activities, the children should learn specific science content. The FOSS curriculum lists the following learner objectives:

1) Air is real and occupies space

2) Air can be compressed

3) Air can move objects

4) Air can be captured in containers

5) Air can slow the fall of objects

6) Moving air can turn a propeller

7) Air expelled through a balloon can propel the balloon

8) Air allows some object to glide

9) Wind is moving air

10) Wind causes some devices to operate

When we gathered the children for the group interviews, we wanted to create an environment that encouraged collaboration to help each other remember concepts, and we wanted them to use either language to express themselves. We asked the open-ended question, "What do you remember learning about air and weather?" The children began slowly percolating comments about the activities and objectives. As soon as one child stated a word another child would pop in with an example or a word that would suddenly come to mind. Soon the children were furiously describing and remembering their science experiences and understanding.

In all, the children generated the description of seven of the eight activities, and they generated comments about nine of the ten objectives, indicating some understanding of the concept. All of these students except one (she moved to the school a month ago and spoke no English) responded to the questions in English and Spanish. This new student, however, did contribute in Spanish to a conversation the others were having in English, indicating that she understood some English.

The children's informal conversation gave evidence of the objectives listed above. They said that air occupies space, can be captured in containers, and can be compressed. During the lessons, the children had been given large syringes with clear plastic tubes on the ends. They explored what happened when they moved the plunger with the syringe end open, closed, or connected to another syringe with a tube. Celia described her understanding of Objective 2, (air can be compressed) this way, "When both of the syringes were closed, the air was pushing." Ellie described the air pressure as "the air was too stuck" while pushing her hands together. Another child discussed how air can move objects, "If you put both on the outside [plunger in the extended position] and you push the first one it will go flying out. Because the air pushes it, so it could go out."

Jon told us about wind direction and moving air. "The windsock is to tell you if the air is coming this way… what side the air is coming."

Alicia described objects gliding on air this way, “If you throw the airplane more hard so it goes farther with the wind. Sometimes when you throw it, it will just stay floating in front of you.”

Celia elaborated on an activity using a plastic propeller and a straw. “We went outside and the air was pushing it, and it turned around and fell down. It stayed up because the air was down and pushing it up” [palms raised and moving up].

In the balloon rocket activity, two segments of drinking straw are taped to an oblong balloon with air inside. This “rocket” is threaded on a nylon string extended between two chairs about ten feet apart. Children inflate the balloon, mount it on the string, and release the balloon. They soon realize that the more air they force into the balloon, the farther and faster their rocket will go. When Maria and Alicia mentioned the balloon rocket, they described in detail in Spanish how to make it. Roberto added that it moved like a jet racecar.

Joel described the anemometer the teacher had demonstrated and how it measured wind speed. He also described the wind vane and said that it “points to where the air comes from.” He told how the plunger in one syringe popped out when the other plunger was pushed in, saying, “The air smushed it out.” He said that at home he made a little cup that went up and down like a space ship. “The wind would blow it up and then it would come down.”

The children did not generate the name for air pressure nor the plunger in the syringe. We provided the term after they described it to us. One child called the syringe a “meat baster.” Ellie told about making a parachute. She forgot the term for it and described “those back packs and you pull the strings for it to open”. She also described the propeller and its motion, but did not say the name. Although Joel could tell about the anemometer and the wind vane, he could not name the instruments.

The generous information generated in such a short time gave evidence that the students learned important science concepts when they participated in the interactive science curriculum, and they retained these concepts throughout the following year. However, they did not provide evidence that they remembered every concept, and, although they could describe an item well, they often did not generate the correct name for the items.

Second Graders Learning Balance and Motion

Six of these same second graders demonstrated an understanding of balance systems being stable or unstable. At the time of this interview in the Fall, they had experienced several lessons in their second unit, *Balance and Motion*. One activity was to predict which of nine pre-drawn systems were stable (will remain balanced when pushed gently) or unstable (will fall with a gentle force) and then to test them. On a paper with nine stable and unstable balance systems, the children were to predict which were stable. After this lesson, Ms. Flores had the children draw stable and unstable systems and write an explanation. Table 3 gives the number of correct predictions for the pre-drawn systems in the second column and the results of their task to draw a stable and unstable system in the third column. Clearly all the children did not fully understand stable balance systems after three lessons, but the chart shows that they did have an understanding of the concept.

Table 3

Second Graders' Assessment, Stable Systems

Student	Correct predictions out of 9	Draw stable/unstable system
Alicia	6	Yes/ no
Maria	3	Yes/ yes
Jon	5	Yes/ yes
Celia	6	Yes / incomplete
Ellie	8	Yes/ yes
Joel	5	Yes/ yes
Jose	7	No/ incomplete
Roberto	absent	Yes/ no

Teachers' Perceptions

The ten teachers met with us formally, in four small group interviews, and informally as we visit the classrooms. In the interviews we asked them to share evidence of their students learning or not learning science concepts. They shared data from their students' written work and their observations demonstrating understanding or lack of understanding of science concepts. In addition, they shared their perceptions about their students' learning. Their comments indicated that they believed that the children are improving rapidly in their vocabulary and concept development. The difficulties of teaching in L2 are still evident, but they felt that the interactive science and dual language program facilitate learning.

When this interactive approach to learning science is presented in a monolingual setting, children dialogue among themselves and with the teacher to clarify their understanding of the new vocabulary and concepts. In a two-way dual language setting, this negotiation between peers with different language dominance becomes more important. On the English day, Spanish-dominant children must gain assistance from their English-speaking peers. The English speakers become a form of teacher or leader. On the Spanish day, this teacher/leader role is reversed. The languages are given equal status and all students must alternate between teacher/leader role and the role of a learner needing extra assistance. They must depend on each other and share information.

Some of the teachers captured the observations, comments, and explorations generated during the student exploration by recording them on a chart with the appropriate child's names. Ms. Jacquez and Ms. Pérez devised a chart and recording system that traveled with the children. Comments during the Spanish lesson were recorded in red, in the English lesson in blue. The chart provided to the teachers important information about which children were verbalizing concepts and using vocabulary in L1 and L2 and which children they had not been able to observe. The teachers also recorded the children's science talk in the "debriefing" session after the lesson when the children are sitting on the rug. The teachers solicited comments from the children about their thinking about their science activities, and these responses were written on chart paper along with the name of the child making the contribution.

The curriculum is designed for each new lesson to build upon the concepts developed in the previous lessons. From their classroom experiences and from listening to the children, the teachers shared

their perceptions of the students' learning science in this active, two-way dual language approach. Because of this progression, when the children went from L1 class one day to L2 class the next day, the teachers reported that there was minimal if any concept loss and all the children are able to fully participate in the science activities.

> Ms. Consuelo Flores: The monolingual English have the content, but they want to try using the new Spanish. The quieter monolingual students [in L2 class] are talking more in their small groups. They remember easily yesterday's lesson and are able to connect right away in the L2 class. They transfer everything in either language. I'm not having to translate or slow down the instruction at all because the background for the lesson is already there.

> Ms. Soto: I couldn't find a better way to get the vocabulary development. When they can't find the word in L2, they jump to L1 so I know the concept is there. Eventually, they use the L2 terms. Even the Spanish L1, they are comfortable with many L2 words like *plywood.*

The teachers agreed that there is a struggle for the children in using the new language. As Ms. Maria Flores told us, "For some it is harder in the L2 class. They turn you off and use their L1." The teachers also gave evidence that the new vocabulary was carrying across languages and into other content areas.

> Ms. Soto: One child told me in English that the grains of sand made the sand paper and in Ms. Flores' Spanish class, he said it is the "papel de arena".

> Ms. Kesler : We had some definitions and pictures on the vocabulary wall since we had done a weather unit. They came up with new vocabulary when they did the air and feather exploration. I introduced the term *compression after* they explored it because they did not come up with it on their own. Now they are using it a lot. They use it even out of science. When it gets stuffy, they say, "The air is compressed in here."

Lessons Learned

Science Vocabulary Retention --Receptive and Productive

Through our observations and the teachers' comments, we know that the children used the new vocabulary during the classroom science activities. Also, the children were able to demonstrate that they had remembered most of the activities and had internalized most of the concepts in the curriculum units they experienced several months previously. To explore this more, we asked the children in one of the classes to tell us orally as many vocabulary terms that they could remember. When we were satisfied that they had a bank of words, we asked them to write "as many words as you can tell me about air and weather". Much of the new science vocabulary was not produced. They remembered words such as sawdust, windsock, and pine. Obviously missing from the students' comments were the correct terms in Spanish or English for science-specific terms such as *compression*, *pressure*, *parachute*, the names of the wood types, *anemometer*, *wind vane*, and *syringe*. The term sinking was not generated. The children used "go down" or "bajar." The children had only a short time to generate their memories and understandings about these science-learning experiences. Given more time and more context, they may have generated more terms.

Nation (2001) talks about receptive and productive vocabulary. Receptive vocabulary can be perceived from more passive sources like listening or reading. Productive vocabulary is actively generated by speaking or writing. (Nation advises us not to oversimplify the complexity of these distinctions, but we will generalize for the sake of this discussion.) There is evidence in this investigation to suggest that the

children in the study had not developed strong productive vocabulary. Nation tells us that, "knowledge of the word form is more likely to be the factor affecting difficulty than knowledge of meaning, and more precise knowledge of the word form is required for productive use, thus making productive learning more difficult than receptive learning" (p. 29). In addition, the learner has more experience receiving vocabulary than generating the new terms. The new terms learned in the science curriculum were not common, everyday language-- plywood, wind vane, and compression. Therefore, the thought level needed to produce these terms quickly and in the right context is more difficult.

Further research should examine the children's ability to recognize the new vocabulary and to produce it in different settings and in both languages. Nations suggests that it is easier to produce words in L2 if the form of the word is similar in both languages. Nation recommends that teachers assist students in second language programs by pointing out the similarities in the words if the two languages are similar (for example, *pressure* and *presión*). More research into children's vocabulary use would inform educators about the implications of identifying and stressing cognates when teaching in dual language programs in science content.

The ability to move a term from receptive to productive is enhanced if the learner has the opportunity to produce the term repeatedly. Teachers can help their children learn new science terms (whether using L1 or L2) by allowing the children ample opportunities to dialogue about their science experiences. Science classrooms, especially in second language settings, should be full of children talking to each other and to the teacher, explaining their science activities and their science thinking. Repeatedly hearing the new terms, having the opportunity to use the new terms in comfortable settings with their friends, and cueing in on similar word structure will enforce the ability to produce the new vocabulary appropriately. Students build their understanding of science terms and concepts by talking about their experiences. This can only happen in social settings with peers, teachers, and family.

Identifying and Building upon Misconceptions

In addition to building receptive and productive vocabulary when children learn science in language-rich social settings, we can identify when they understand new concepts and also when they have misconceptions. These misconceptions are incorrect interpretations or responses formed by prior knowledge and experience or their new knowledge construction (Helm & Novak, 1983). In an isolated, teacher-directed curriculum, these misconceptions lie buried and form unsound bases for new understandings. However, in a thinking-centered curriculum, teachers engage students in experiences that expose their understandings and misunderstandings. The teachers use information about these misunderstandings to help them develop and refine concepts. "Constructivist teachers engage students in experiences that might engender contradictions to their initial hypotheses and then encourage discussion" (Brooks & Brooks, 1999, p. 112).

In one activity, the children dropped water on different wood samples and made observations. They explained in their own words that the absorption rate was different for the different kinds of wood. One student stated that there was a difference in the speed of absorption of the water because the pressed wood was hot and the redwood was colder. The teacher probed deeper and the child told her he could feel it. The class noticed that the wood got warm when they were sanding it with sandpaper, and perhaps he transferred this idea to this next lesson. One child said that the plywood was hotter than the redwood when they were sanding it. If there was a difference in heat, it was due more to the amount of friction and less to the type of wood. The teachers turned these kinds of misconceptions into questions such as, "Is the plywood hotter than the redwood?" and "How could you test that?" This left the children the option to explore these questions or leave them as open "hooks" to address as they continue the investigations. It is the language focus in the interactive science that allows us to identify these misconceptions and form later investigations based on the children's need and interest.

Lemke (1990) describes science learning as an interactive process, situated in the context of a rich learning environment, where social, cultural, and symbolic stimuli are internalized. This inner activity forms the knowledge. Feeding the inner activity is language. The importance of talking in science learning cannot be reduced. The ability to talk to a peer or teacher, as a concept is developing, feeds the inner activity and builds .

Summary

This research provides evidence of science content development when science instruction is presented through an interactive approach in a two-way dual language classroom. The experience described in this paper provided a win-win situation for the children. The interactive science learning was a vehicle for content and vocabulary development for second-language learners. Also, the two-way dual language system of alternating days provided a structure for the content development to occur even though every other day's learning was in the target language. Although the children were learning the science half in their home language and half in a target language, the science content was not compromised. The children were able to recall quickly almost every activity they had participated in and almost every concept presented in the science curriculum even after the lapse of several months. Most of the children successfully demonstrated understanding of sophisticated concepts such as stable and unstable systems. The teachers used several data gathering tools to inform their perceptions that the children were learning science in both language settings.

There were gaps in the children's ability to generate from memory the new terms for the new concepts. This is probably a natural progression for young children in learning new vocabulary and especially new vocabulary in a second language. Teachers of young children in bilingual programs should keep this in mind and provide varied experiences using the vocabulary that is appropriate for the development levels of the young children.

A benefit of this combination of interactive science and dual language instruction was the ability to probe deeply into the students' understanding and vocabulary. The interactive curriculum made it natural for children to speak about their science, and the equal use of the languages allowed them to do so comfortably. At this juncture of curriculum and language, the teachers could identify when concepts were formed, when new vocabulary (L1 and L2) was used, when misconceptions were present, and when vocabulary moved from receptive to productive use. The contribution of the dual language approach at Serna School, plus the interactive science with a strong focus on student dialogue, created a rich environment for science understanding to develop and language to grow.

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Border Teacher Spanish Language Proficiency:

21st Century Bilingual Educators

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Abstract

This article describes a research study into the attitudes of bilingual teacher education candidates toward their Spanish language proficiency. In addition, this article investigated participants' experiences in developing their Spanish language proficiency. The participants found academic subjects like math and science to be more difficult to teach in Spanish than subjects like reading and language arts. The participants educated in Mexico reported the highest levels of Spanish language proficiency. Many of the participants born in the United States reported negative experiences learning Spanish in schools in the United States.

Introduction

According to the National Clearinghouse for English Language Acquisition the number of English language learners (ELLs) in the United States has increased from two million in 1990 to over three million in the year 2000. Nationally, the increase in the number of ELLS has led to a shortage of bilingually certified teachers (Barron & Menken, 2002). In Texas, 38% of the teachers hired for bilingual/ ESL education positions in September 2002 were not fully certified (Sparks, 2003). One important factor impacting the use of the native language in the classroom is the development of teachers who are proficient enough in the native language to deliver instruction. Bilingual education programs are founded on the belief that the use of the native language in schooling is an aid to students acquiring English (Cummins, 2000). This study investigated how teacher candidates in a teacher preparation program at a US-Mexico border university felt about their Spanish language proficiency and their experiences in becoming Spanish speakers.

Spanish Language Proficiency

According to Riegelhaupt (1995), bilingual education teachers differ from the traditional English instruction teachers in that they must be able to deliver content instruction in two languages. Teachers in bilingual programs are expected to deliver content instruction in Spanish in areas as diverse as mathematics, science, language arts and reading. A number of educators have described the importance of teacher language proficiency for delivering effective content instruction.

Spanish teachers' academic language proficiency is important in that teachers with higher levels of Spanish proficiency are more effective at delivering instruction (Bolgar, 1967). According to Guerrero (1997), bilingual teachers need to develop Spanish language proficiency in order to teach across the curriculum. A high level of Spanish proficiency is important because content areas require domain specific vocabulary and syntax.

According to Chamot and O'Malley (1986) science requires the use of vocabulary in unique contexts like the word 'table,' which has a different meaning in an academic context from a conversational context. Science also has longer noun phrases and heavy use of the passive voice. Spanos, Rhodes, Dale & Crandall (1988), report that in mathematics there are specific linguistic features like comparatives, and use of the passive voice. In addition, like science, mathematics has unique vocabulary, a unique "mathematical register" and manner of mathematical discourse (Moshkovich, 2002). The unique linguistic features attributed to the content areas contribute to the difficulty that students have with what is called "academic language" (Solomon & Rhodes, 1995).

Teachers who have not developed high levels of Spanish language proficiency may have difficulty delivering content instruction in Spanish. This difficulty however, may not apply to all areas of content instruction. Khisty (1995) found that teachers in mathematics lessons primarily used Spanish to discipline students and to get their attention. These same teachers used Spanish consistently while delivering reading and language arts instruction.

Teacher Education Programs and Spanish Language Proficiency

Teacher education programs for bilingual educators have the dual task of preparing teachers pedagogical skills as well as preparing them to teach in Spanish. However, according to August and Hakuta (1997), very little research has been conducted on the effectiveness of bilingual education teacher training. Teacher education programs in large part do not focus on developing Spanish language proficiency for bilingual teachers. According to Freidenberg (2002), many university policies work against the development of bilingualism as they focus solely on English language instruction across the content areas.

According to Merino, Trueba, and Samaniego (1993), the development of Spanish language proficiency is the result of an interplay of community, school and individual factors. In order to acquire a language the individual must be exposed to the language at home and/or in the community. Although students may be exposed to Spanish at home or in the community, they may not acquire Spanish because of individual factors like desire to assimilate.

As teacher preparation programs focus on methodology and content instruction in English, they expect the student to arrive at bilingual education programs with sufficient proficiency in Spanish. Spanish language proficiency is generally left to the Spanish language department and to the students' own experiences with Spanish. These experiences include family relationships, school and university classes (Guerrero, 2003a).

According to Guerrero (2003b) bilingual education students at a large state university took different paths to becoming bilingual. The non-Latino students and Latinos born and educated in the interior of the United States (Interior Latinos), had the least exposure to Spanish and had the most concern about their Spanish language proficiency. On the other hand, Latinos who grew up near the border and Latinos educated in Spanish-speaking countries felt they had developed high levels of proficiency in Spanish. In order to improve the Spanish language proficiency of bilingual education teacher candidates, university programs must be aware of teacher candidates' bilingual proficiency and what environmental factors influence their linguistic development.

Purpose and Questions

The purpose of this study was to investigate the perception of Spanish language proficiency of students taking bilingual education methods courses. In addition, this study was designed to examine how students became bilingual through their interactions at home, at school and in the community. The following questions were asked in order to investigate teacher candidates' feelings about their Spanish language proficiency.

1) How do teachers feel about their basic Spanish language proficiency skills (reading, writing, speaking and listening)?

2) How do teachers feel about their ability to teach in Spanish across the content areas (science, mathematics, reading, language arts and social studies)?

3) What environmental factors influenced their development of Spanish (home, school, community and university)?

Methodology

An online survey of Spanish language proficiency was created to better understand the level of proficiency that students felt about their language and how they came to that level of proficiency (See Appendix). The development of the Spanish Language Proficiency survey was based on Guerrero's (2003a; 2003b) interviews of bilingual education teachers which were based on semi-structured interviews on the participants' experiences from birth to adulthood. The survey was piloted with two classes of bilingual education teachers and modified to its current form. The survey was given to students who were taking the first course of the content area bilingual methods program which is taught in Spanish. The participant pool consisted of two classes of 19 students in each class. Of the 38 possible students, 28 participated in the survey.

The accuracy of self-assessments depends on the task to be assessed. Self-assessments can suffer from a social-desirability bias in that they may want to rate themselves higher because of a desire to be seen in a good light. Students are more accurate on self assessments if they have had previous feedback in the area being assessed (Delgado, Guerrero, Goggin, & Ellis, 1999). According to Delgado et al., (1999) Hispanic students' self-ratings of their Spanish ability correspond to objective measures of Spanish language proficiency. They suggest that self-ratings of Spanish language ability by Hispanic bilingual students could be used as a preliminary screening device. Validity of this self-assessment is increased as the participants have had feedback on their proficiency through course work and testing.

The students who agreed to participate were given instructions on how to complete the online survey. The major concern for conducting online surveys is that it may result in coverage bias as only students with access to computers are able to complete the survey (Solomon, 2001). To address this issue, students completed the survey in the computer lab at the university, so all had access to the survey. The survey was limited to 20 questions, and the survey was confidential. Limiting the number of questions and keeping the survey responses confidential are two ways of getting respondents to complete the survey rather than quit before completing the survey.

The survey consisted of 20 questions, three demographic questions, 10 Likert type questions and seven open ended questions. The first four Likert type questions were designed to evaluate the students' feelings about their general proficiency levels. Students rated themselves based on these descriptors: 1 is poor, 2 is below average, 3 is average, 4 is above average, and 5 is exceptional.

The last six Likert type questions were designed to gather information on the students' perceived ability to teach in Spanish across the content areas. The students rated themselves based on a scale of 1 for not at all comfortable, 2 is somewhat comfortable, 3 comfortable, 4 is very comfortable, 5 is exceptionally comfortable.

Finally, there were seven open ended questions designed to have students describe their opportunities to learn Spanish and to participate in a Spanish language community. These questions were designed to gather information on the participants' experiences in learning Spanish.

Participants

Texas Border University (not real name) students typically live in the geographic area around the university. Many of the students are first generation college students from working class families. Students in the program are working toward certification in bilingual education. The students who participated in the study take three paths to certification: traditional, alternative certification, or emergency certification. (As of this writing teacher candidates may also teach with probationary certificates.). Traditional students take courses full time at the university and are seeking a degree in education. Alternative certification students have a degree outside the field of education and are seeking a teaching certificate while they are working in the schools. Emergency certification teachers have a degree and are also seeking a certificate while they work in the schools until they have completed their coursework.

All of the students who took the survey were taking an initial class in the teaching of reading in a bilingual setting. The students identified themselves as either Hispanic or Mexican American. The average age of the students who took the survey was 29 years with a range of 21 to 47. There were 16 students in the traditional track, eight in the alternative certification track and tour

The University Setting

Texas Border University has a highly bilingual environment and the teachers in the bilingual cohort exhibit high levels of Spanish language proficiency. Spanish and English are commonly heard on campus and in the community surrounding Texas Border University. Spanish language media like television, magazines and newspapers are also commonly available in the community. Texas Border University students have a 98% passing rate on the Texas Oral Proficiency Test required for bilingual certification in Texas.

The Spanish content area methods program at Texas Border University was created to meet the criteria for the new Texas certification of EC-4th grade bilingual generalist. The Spanish content area methods program consists of three courses which address: emergent literacy, reading methods and content area methods

These courses are all taught in Spanish using textbooks and other materials in the language of instruction. In addition the students are expected to communicate and complete all assignments and examinations in Spanish.

Data Analysis

The initial data organization was based on the questions from the survey instrument. The data were sorted based on the development of an overall average of the students' self-reported proficiency levels. The Overall Proficiency Scale (OPS) is an average of the 10 numerical scores from the survey. The OPS then gives a measure of the students' feelings about their Spanish language proficiency as well as their comfort level teaching in Spanish in a bilingual classroom.

Table I

Number of Participants by OPS Rating

OPS Rating	Participants
2.0-2.9	9
3.0-3.9	8
4.0-5.0	11

Based on the categories of low (OPS 2.0-2.9), middle (3.0-3.9) and high (4.0-5.0) the researchers examined the open ended questions for similarities within each group. These similarities were coded as themes (Miles & Huberman, 1994). A peer review of the data was conducted in order to validate the original themes (Schwandt, 1997).

Findings

Likert Question Findings

Not surprisingly students indicated that they were most comfortable understanding spoken Spanish and that writing was the most difficult task. Listening to spoken Spanish requires attention to meaning while writing requires active attention to both form and meaning. The students rated reading and speaking as equally difficult tasks. The means across type of certification program were similar.

Table II

Spanish Language Proficiency Self Ratings (N=28)

Ability to Read	3.9
Ability to Speak	3.9
Ability to Write	3.5

Table III

Content Area Self Reported Spanish Language Proficiency (N=28)

Content Area	Mean
Teaching Reading	3.6
Taking Classes in Spanish	3.5
Teaching Language Arts	3.5
Teaching Social Studies	3.4
Teaching Math	3.3
Teaching Science	3.0

The overall averages for the students' perceptions of their academic language had means below that of the more basic language skills. Cummins' (2000) theory that academic language tasks place an additional strain on the language user is reinforced through this finding. In addition, students indicated that they were least comfortable teaching academic subjects like math and science and most comfortable teaching courses like reading and language arts. As Khisty (1995) suggests, students seem to have a higher comfort level with more conversational content areas like reading and language arts and less comfort with content areas .

Open Ended Question Findings

The findings from the open ended questions were sorted into three categories based on the results of the Likert questions. The themes which emerged from the data for each group were experiences at home, experiences at school, experiences in the community and experiences at the university.

Low Group (OPS 2.0-2.9)

All of the participants from Texas Border University reported speaking Spanish at home as children. The foundation of the participants' current level of proficiency in Spanish was built at home. The participants from the low category reported a high level of influence of English once they reached school. The influence of English seemed to lead to a loss of Spanish in favor of English language development. One respondent reported, "Spanish was my first language, but now even my grandparents prefer to speak English." Several members of this group also reported learning non-standard Spanish at home due to the influence of English. The following statements were taken verbatim from the questionnaire.

> I learned Spanglish at home as a child. Lately, I've stopped to listen to myself once in a while and am amazed at how stupid and uneducated I sound. My parents had only an elementary education in Mexico. The siblings I have that do speak English tend to mix both languages into one. I believe this is where I picked up Spanglish.

Schooling in Spanish for this group was rare. The lack of education in Spanish led to limited experiences with literacy development in Spanish. Lack of experience reading and writing in an academic context made this group feel insecure about taking courses in Spanish and using Spanish in a more formal context.

> I learned Spanish because my family at home spoke Spanish but I was never taught how to read or write I just spoke it. I can write it but I need help with accents other than that it is good.

In addition, many reported not being allowed to speak Spanish at school creating a negative environment for Spanish language development. As one participant wrote, "During my elementary school years, we were not allowed to speak in Spanish in the classroom. Students back then were told to speak only in English while in the classroom." Some in this group also felt pressure not to speak Spanish in the community. "I had a lot of problems with my boss because she was Anglo and didn't understand what it's like to be Hispanic in Texas.....She....used to tell us if she heard us speaking Spanish, we would be going to the unemployment line."

Several participants in this group also expressed a sense of inadequacy when speaking Spanish especially when placed in situations with fluent Spanish speakers. For example, "If someone asks me something in Spanish I try my best to answer in Spanish but I end up sounding goofy." Students expressed how their Spanish has developed at the university level.

> In the University level I have learn how some words have asentos [sic] and about the present past and future. I have practice reading in Spanish which helps me see and understand about how to write in Spanish.

However, several participants reported that they were ridiculed at the university by more fluent Spanish speaking peers and faculty. This has led to negative feelings toward Spanish and fluent Spanish

> My Spanish in the university level has been very hard for me to comprehend what I read. I have learned to hate Spanish because at one time I thought I knew what I was saying but was made to feel utterly stupid.

Middle Proficiency Group (OPS 3.0-3.9)

The middle group was very similar to the low group in their experiences with Spanish at home and at school. They reported learning Spanish as a child at home, and then they were not allowed to use it at school. Family support for Spanish seemed to be one factor which helped this group maintain a moderate sense of proficiency. The pressure to assimilate seemed to be high for this group, and use of Spanish seemed to be limited to speaking to older adults like parents or grandparents.

> As a child I can remember not wanting to speak Spanish very much. I believe this happened because I had some bad experiences as a child. My family were migrant workers and as I grew up my father struggled to keep me learning Spanish while all I wanted was to learn everything I could in English. I wasn't trying to rebel. I just wanted more acceptance I think.

In addition, the use of Spanish in the community was a more significant factor for this group. The requirement to use Spanish in the community and at the university has helped this group maintain its Spanish language proficiency. Many of the respondents reported experiences with Spanish at work or church, "The place where I work consists of speaking Spanish about 90% of the time. In the community it is about the same." Unlike the low group this group seemed to have more positive feelings about its experiences with Spanish.

> Coming back to school was hard at the beginning. I returned to the university after 14 years...these Spanish classes have helped me understand the language that we speak but have not studied.

High Proficiency Group (OPS 4.0-5.0)

The high group differed greatly from both the medium and low group in that they reported having been schooled for at least some time in Mexico. This group reported either having elementary or secondary school taught in Spanish. This group was also more likely to report literacy experiences in Spanish.

> Great, since I come from a Mexican family. Half of my life I lived in Mexico. Spanish is a very rich and more complicated language to learn than English (in this case). As a child I only spoke Spanish at home. I used to study English in Middle School and High School.

This group seems to report more of a cultural connection with Mexico and with Spanish in general. They did not report negative experiences with schooling and were more likely to have positive experiences.

> My native language is Spanish. I went to school in Matamoros up to 9th grade. Comparing both countries I like more Mexico because I did not like to be move (sic) from classroom to classroom.

Spanish is an integral cultural component for this group in the community. For this group the speaking of Spanish is intimately connected with the home and community.

> Mis padres siempre me han hecho entender desde niña que mi lengua materna - el español- es muy importante en mi familia y que siempre va ser parte de mi cultura. No hay razón de avergonzarme. Soy una Testigo de Jehová y mis reuniones son en español y desde niña eso me ha

> ayudado mucho en seguir desarrollando mi español. (My parents always have made me understand that my native language, Spanish is very important in my family and that it will always be a part of my culture. I don't have any reason to be ashamed. I am a Jehovah's Witness and our meetings are in Spanish and this has helped me continue developing Spanish from childhood.)

The use of English for this group is limited to activities in the work place and experiences outside the home. As one participant reported, "I mainly speak Spanish at home because my family does not speak English. Only at work I speak English."

Unlike the middle and low group, this group is also very comfortable taking courses at the university level in Spanish and the following example indicates the high level of Spanish this group has generally maintained while acquiring English. This group also works to speak, read and write standard Spanish. As one participant wrote,

> I completed a translation certification program at the University. I have taken several courses in Spanish and English-Spanish translations, so my personal experience is wide. There has been more demand for courses in the Spanish language, and more people are taking Spanish classes whenever they are offered. I have noticed that the local level of knowledge of the language is low in this area. There is a need for higher academic level in some areas, and the need to stress to students the importance of speaking it and writing it right, but I guess the cultural side of it plays a great part in the process also.

Discussion

Clearly the differences between the participants with the highest level of proficiency and the others is based on their schooling in Spanish. Even in a high level Spanish community we see students pressured to assimilate into English language culture. In the United States, communities with high levels of Spanish language proficiency and with close connections with Mexico show a general shift towards the use of English in the home by immigrants (Pease-Alvarez, 1993). This shift is compounded by school policies which attempt to eliminate Spanish use in the classroom.

In evaluating the perceptions of bilingual educators from a border region towards their Spanish language proficiency, we found that the border shapes and affects the identities of the people who live on the border. Teachers in bilingual education take the experiences and identities they have and then help shape future generations of Mexican-Americans through their work with young children. A central feature of the development of identity is language, and for many Latinos, the issue might be assimilation or resistance.

According to Trueba (1999), Latinos in the United States often form multiple identities and adapt in order to survive in this country. "If we speak English fluently, and if we exhibit the expected gestures and kinesics characteristics of European Americans, people will never know our internal struggles in defining ourselves" (154). Teachers who want to teach in bilingual programs are directly impacted by this identity conflict as they are faced with the dual task of maintaining a first language well enough to deliver instruction in that language as well as enough English in order to succeed in primarily English speaking educational facilities.

The United States born participants' attitudes toward Spanish were affected by their exposure (or lack of) to academic language. As discussed by Guerrero (2003b), there are few models of academic Spanish language in the schools and communities for development of bilingual ability. The use of Spanish was generally limited to non-academic contexts. Some participants even felt embarrassed by their Spanish

language ability. Many participants seem to feel that their community level of Spanish is sufficient without developing academic Spanish.

The participants who reported the highest level of proficiency in Spanish were educated in Spanish-speaking schools in Mexico. This seems to indicate that even 30 years after the development of bilingual education in Texas there has been little impact on the use of academic Spanish in the schools. This continues at the university level where bilingual teacher candidates are expected to prepare to teach in Spanish yet their course work is 95% in English, as well as all of their certification tests, including the bilingual certification tests.

Conclusions

The ability to generalize from this study is limited in that the conclusions are based on a small sample of teachers. In addition, the context of the university community along the border is very different than is found in areas away from the border. Generalizing these findings to programs away from the border would be difficult in that there is proportionally less access to Spanish in the community.

Some conclusions can be drawn from the findings. In order to better meet the needs of bilingual education students it is important that teachers have high levels of academic Spanish language proficiency. In order to improve language proficiency it seems clear that future teachers need to be taught academic subjects in Spanish. Participants seem to have the most concern about teaching course material in content areas like math and science. Even Spanish majors at the university level are unlikely to take courses in math and science in Spanish. Most universities only offer courses in literature and social studies in Spanish. Offering courses in Spanish in science and mathematics would help teachers become more comfortable using the linguistic features and vocabulary of these academic disciplines.

Offering methods courses to bilingual students will help them prepare to teach in Spanish in the academic setting. Textbooks in Spanish can be purchased from academic publishers from Spanish speaking countries and some have been developed in the United States as well. Reading course materials and practicing classroom presentations in Spanish appears to benefit students who have little academic experience with Spanish.

The development of strong forms of bilingual education such as two-way and developmental programs in public schools would improve and increase the pipeline of bilingual education teachers. For most United States born bilingual teachers, the public education system seems incidental to their development of Spanish language proficiency. Development of academic Spanish language proficiency from kindergarten through secondary school would give a foundation for teachers wanting to teach in the content areas in Spanish.

In conclusion, it seems apparent that we still feel uneasy about speaking Spanish in this country. Even along the US – Mexico border, the pressure to assimilate into English language culture is high. University programs must work within state guidelines which seem to contribute to low levels of Spanish language proficiency. However they can also contribute to improved instruction by targeting students' development in the areas they are weakest which are math and science.

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Appendix

Survey Questions for Spanish Language Proficiency of Bilingual Education Teachers

Question 1 age

Question 2 ethnicity

Question 3 Rate your level of understanding of spoken Spanish.

Question 4 Rate your speaking ability in Spanish.

Question 5 Rate your level of reading ability in Spanish.

Question 6 Rate your level of writing in Spanish.

Question 7 How comfortable are you taking courses in Spanish?

Question 8 How comfortable are you teaching math in Spanish?

Question 9 How comfortable are you teaching Science in Spanish?

Question 10 How comfortable are you teaching reading in Spanish?

Question 11 How comfortable are you teaching language arts in Spanish?

Question 12 How comfortable are you teaching Social Studies in Spanish?

Question 13 Describe your learning experiences with Spanish as a child at home. **Question 14** Describe your learning experiences with Spanish in elementary school. **Question 15** Describe your learning experiences with Spanish in secondary school (middle and high school).

Question 16 Describe your learning experiences with Spanish at the University level. **Question 17** Describe your current level of exposure and use of Spanish at home. **Question 18** Describe your current level of exposure and use of Spanish in the community.

Question 19 Describe how important is Spanish for you personally in your work and home environments?

Question 20 Are you currently either a traditional or ACP student?

Texas Dual Language Program Cost Analysis

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From 1992 to 2004, Texas experienced a 92% growth in the English Language Learner (ELL) population, which amounted to 660,707. (National Clearinghouse for English Language Acquisition, 2004). This dramatic increase places Texas second only to California in the number of school-age ELLs, and along with this demographic change comes a focused attention on effective educational programs for ELLs. Dual language (sometimes referred to as two-way immersion) bilingual programs have seen an increase nationally and a significant increase in Texas due to research that shows positive academic, linguistic, and affective results for ELLs and their English-speaking peers. However, there is a paucity of information available about the costs associated with implementation and maintenance of dual language programs. Conducted in Fall 2004 by Texas A&M University, Sam Houston University, and University of Texas Pan American, this study represents the first detailed cost analysis study of Texas dual language bilingual programs and is the only known study of its kind nationally for dual language programs.

Texas mandates that every student who has a home language other than English and therefore is identified as Limited English Proficient (LEP) should be provided an opportunity to participate in bilingual or English as a second language programs (Texas Education Code Chapter 29, subchapter B). In fact, all school districts with at least 20 ELL students within the same language classification in the same grade level district-wide must offer Bilingual Education (BE), English as a Second Language (ESL), or an alternative language program must be implemented (TEC Chapter 29, Subchapter B). Along with the program models of English as a second language, English immersion, and transitional bilingual, the State acknowledges two-way / dual language bilingual education.

Dual Language Education

Dual language (DL) programs strive to develop bilingualism and biliteracy skills in all students, language minority and language majority alike (Christian & Whichter, 1995; Valdes, 1997) in addition to fostering language equity (Torres-Guzmán, 2002). DL programs are also sometimes referred to as two-way developmental or dual language immersion and are considered as an inclusive bilingual model. Such programs include the following components: (a) instruction through two languages, (b) use of one language during periods of instruction, and (c) integrated participation of both ELLs and native English speakers in most content instruction (Lindholm, 1987).

Theoretical Foundations of Dual Language Programs

Strategies implemented within DL programs are based on critical linguistic, pedagogical and theoretical principles. The major theoretical principles are: (a) cognitive academic language learning requires five to seven years (Collier, 1992; Cummins, 1991); (b) students can transfer knowledge and skills from one language to another (Cummins, 1981, 1991); and (c) continuous development in two languages enhances learners' educational and cognitive development (Collier, 1992; Cummins, 1992). Christian (1994) stressed that the goal of DL programs is to balance the development of language, academic, and social development and not to choose or sacrifice one over the other. According to Thomas and Collier (1997) there are six critical factors that contribute to the success of DL programs: (a) students participate for at least six years, (b) there is a balanced ratio of speakers of each language, (c) there is a separation of languages, (d) emphasis is on the minority language in the early grades, (e) core academics are emphasized as well as instructional excellence, and (f) parents have a positive relationship with the program. Lindholm-Leary (2001) added the following three to the list of critical success factors: (a) effective leadership and support by administrators and instructors, (b) a positive school environment composed of an additive bilingual environment, and (c) high quality instructional personnel and staff training.

DL Research Support

Research studies in the fields of bilingual and DL education have indicated that academic achievement is very high for both language minority and language majority students participating in the program when compared to students receiving English instruction only (Cummins & Swain, 1986; Lindholm & Aclan, 1991; Thomas & Collier, 1997, 2001). DL programs allow native English speakers to develop advanced second language proficiency without sacrificing L1 development of academic proficiency (Genesee, 1987; Swain & Lapkin, 1982). In their recent national study, Thomas and Collier (2001) found that, enrichment 90:10 and 50:50 one-way and two-way developmental bilingual education (DBE) (or dual language, bilingual immersion) are the only programs to date that assist bilingual students to reach the 50th percentile in both L1 and L2 in all subjects. In addition, these programs enable students to maintain a level of high achievement and to reach even higher levels through the end of schooling. Notably, the fewest number of dropouts are reported by these programs. (Refer to the full report at http://www.crede.ucsc.edu/research/llaa/1.1es.html).

Dual Language Program Types

DL programs vary in the amount of instructional time spent in the L1 and L2 and the length of the programs. The most common models are known as 50:50 or 90:10 models (Christian, 1996).

90:10. In 90:10 models, for about 90% of the instructional day, Spanish (or other minority language) is the medium of instruction and English is gradually increased until it reaches approximately 50% in the upper grades in elementary school (fifth or sixth grade). Beginning literacy instruction is most often taught in the target language, i.e. Spanish or other minority language.

50:50. In 50:50 models the instructional day is equally divided between English and Spanish from Kindergarten throughout the duration of the program. Language arts or literacy instruction varies from L1 literacy to L2 literacy or simultaneous teaching of both literacies.

Other Program Characteristics

DL programs also vary in the length of the design (some continue to 12th grade while others phase out in elementary or middle school). Further, programs vary in the percentages of "majority" and "minority" speakers and languages of instruction; however, nearly all of the DL programs in Texas are Spanish/English. Within DL programs, the English speakers experience an emphasis on the minority language (Spanish) first, and the Spanish speakers experience a maintenance model in which their native language literacy is developed.

According to Alanís (2000), the majority of Texas students are served in transitional bilingual programs (49%) or ESL programs (38%). Transitional bilingual and ESL programs are often viewed as "subtractive" and/or "deficit" models of teaching ELLs (Gómez, 2000; Hernández-Chávez, 1984; Ovando, Collier, & Combs, 2002). In such models, students experience "subtractive" native language and "subjugate" their native language to the majority language. Student proficiency in English and rapid mainstreaming into grade-level classes are the goals of transitional programs; therefore, these programs may be viewed, as "remediation" models where students are perceived as lacking in English skills and therefore in need of quick English remediation. Conversely, DL programs are often described as "language additive or language maintenance" programs in which students acquire a second language (L2) while maintaining their first language (L1) (Cloud, Genesee, & Hamayan, 2000).

Number and Types of DL Programs in U.S. and Texas

United States. According to the Center for Applied Linguistics' *Directory of Two-Way Immersion Programs in the U.S.* there were 248 two-way programs in 23 states and the District of Columbia in 2000. This directory also reported an expansion within existing programs adding new grade levels each year, and 40 programs extended into the middle or secondary grades. The 2000 CAL Directory indicated that the majority of the programs are Spanish/English programs (234 out of the 248). Additionally, data collected uncovered tremendous variability in program implementation (Christian, 1994).

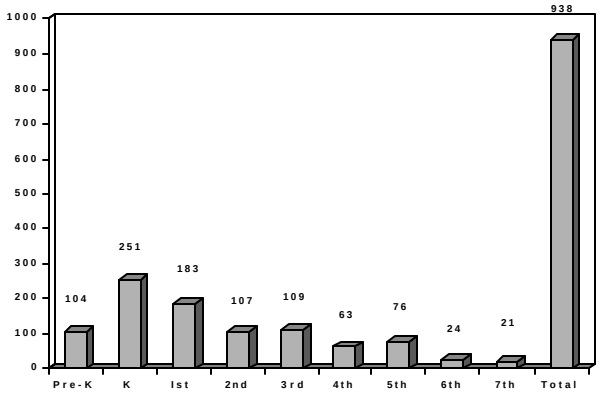
Texas. The Texas Education Agency (TEA) collects basic school descriptive data about Texas districts and ELL programs through a software program called PEIMS (Public Education Information Management System). According to the TEA, "in compliance with the Texas Education Code, PEIMS contains only the data necessary for the legislature and the TEA to perform legally authorized functions in overseeing public education. It does not contain any information relating to instructional method, except as required by federal law" (Refer to http://www.tea.state.tx.us/peims/about.html). Therefore, the State does not collect specific information about bilingual program type. However, nationally, the Center for Applied Linguistics (CAL) has been collecting data and monitoring the growth of two-way programs in the U.S. since 1991.

In 2000, the CAL *Directory of Two-Way Immersion Programs in the U.S.*, (http://www.cal.org/twi/directory) identified 39 dual language schools located in 17 districts in Texas. At that time, there was no known directory created exclusively for the purpose of identifying DL schools in Texas. To this end, in December 1999, a Texas-wide group of bilingual and dual language educators formed the Texas Two-Way/ Dual Language Consortium (TTC) to address three fundamental needs: (a) create a Texas directory of DL schools, (b) consolidate Texas-wide research on the effectiveness of these programs, and (c) positively impact state and local policy. The TTC commissioned an expansive statewide project supported by Texas A&M University's Bilingual Education Program. The purposes of the project were to create a website (to identify DL programs across the state) and serve as a network resource. By the end of 2001, the TTC was able to identify 63 DL programs located in 32 school districts. By the end of 2003, 166 programs were identified. Fifty-three percent used a 50:50 model, while 47% employed a 90:10 model. According to CAL, nationally, the 50:50 model is the most frequently reported type of DL program (Lara-Alecio, Galloway, Irby, Rodriguez, & Gómez, 2004).

DL Programs by Grade Level and Classes

Lara-Alecio et al. (2004) reported that the majority of DL programs in Texas are situated at the early elementary levels (Refer to Figure 1). They further noted that nationally, DL programs are frequently implemented at grade levels PK-3. CAL's 2000 directory showed 39% of DL programs are situated at the early elementary grades while 40% continue on to the upper elementary grades. The Texas data from the Lara-Alecio et al. (2004) report indicated that 58% of the classes are in grades PK-2 which are higher than the national percentages; however, this percentage also implies that many of the Texas programs are "recent" programs that are adding grade "levels" each year versus mature programs with campus-wide

Figure 1. Texas grade levels and classes. (Lara-Alecio et al., 2004)



DL Programs by Language of Instruction

In the 2004 Lara-Alecio et al. report, it was noted that all Texas DL programs used Spanish and English as the languages of instruction. Two programs reported using a third foreign language for enrichment (French or American Sign Language). According to the CAL national data, Spanish and English are the predominant languages of instruction in DL programs in the U.S. (Center for Applied Linguistics, 2002).

DL Distribution of Native Spanish and Native English Speakers

Further reporting on DL programs, Lara-Alecio et al. (2004) found that 47% had a language ratio of 75% native Spanish (NS) speakers to 25% native English (NE) speakers. The optimal instructional environment in DL programs is an equal division of native English and Spanish speakers. Nearly half of the programs reported being near balanced between native Spanish and English speakers (27% were 50/50 and 20% were 60/40). Only 6% of the programs were weighted in favor of native English

Figure 2 depicts the DL programs by language distribution (Lara-Alecio et al., 2004).

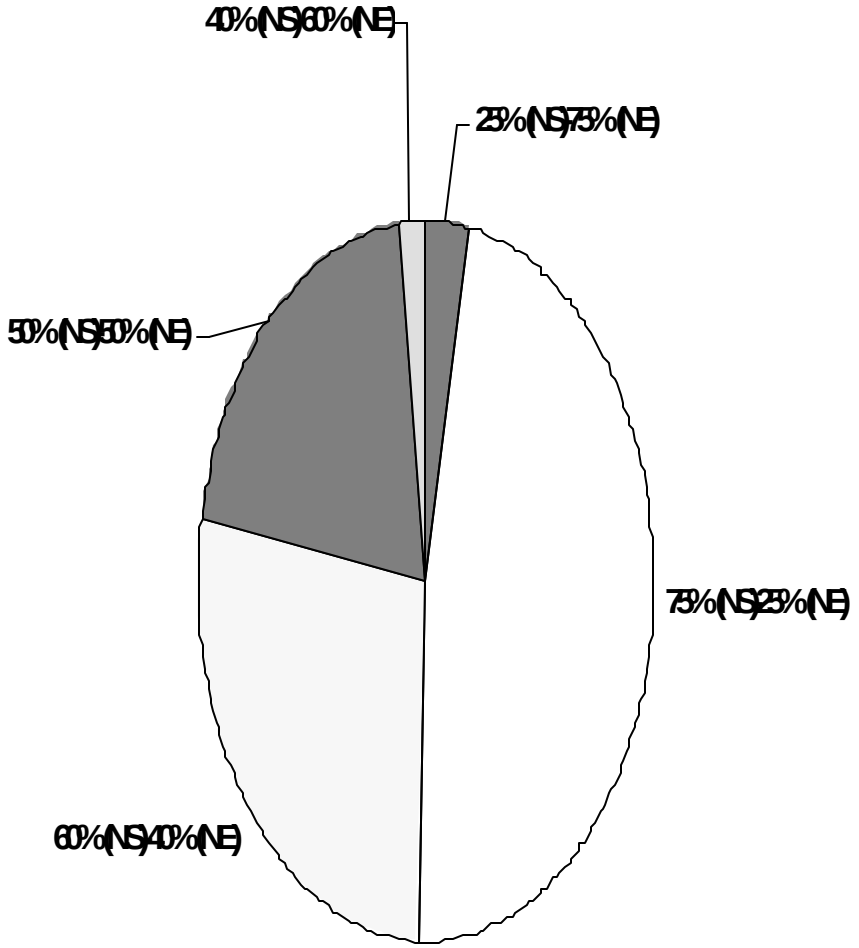


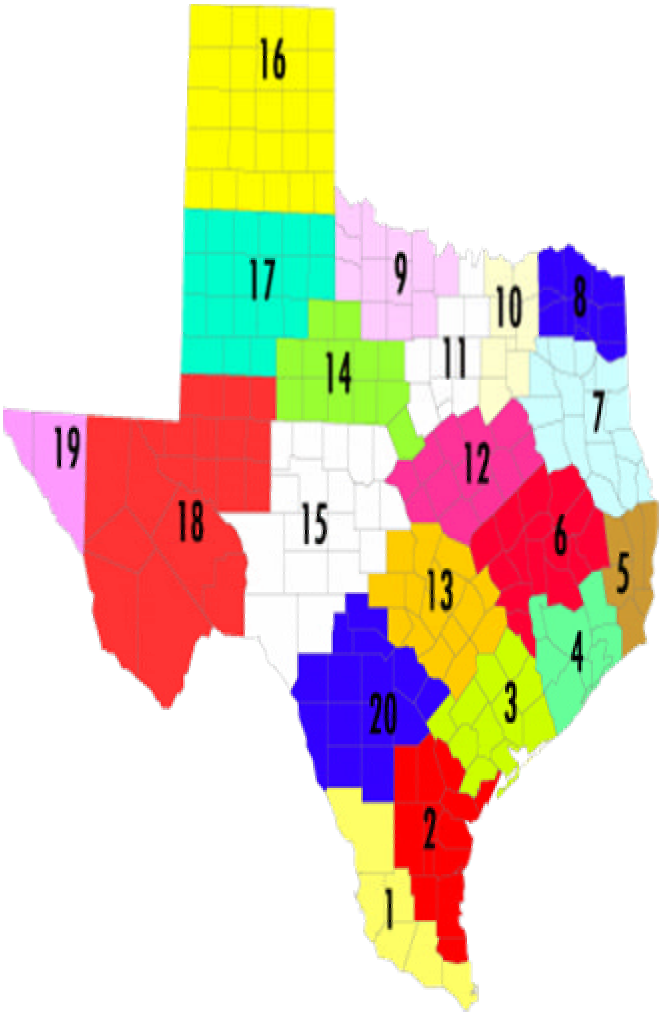
Figure 2. Distribution of native Spanish (NS) speakers to native English (NE) speakers.

(Lara-Alecio et al., 2004)

Figure 3. Language Programs by Regional Education Service Centers

(Lara-Alecio et al., 2004)

The state of Texas is divided into 20 Regional Education Service Centers (ESCs) that function as assistance centers for the Texas Education Agency and local public school districts. Figure 3 depicts a map of Texas by ESCs. Data indicated that DL programs are implemented in 14 of the 20 ESCs. Region 1 reported the most DL programs with 26.5% of the programs. Region 1 is situated in the Lower Rio Grande Valley and has a large percentage of Spanish-speaking students due to its proximity to the U.S.- Mexico border. Notably, two other areas, Region 4 (Houston area) and Region 19 (El Paso area) also had a large percentage of the total DL programs with 23.8% and 24.3% respectively.



Percentage of DL Programs by Regional Texas Education Service Centers.

Collectively, these three regions contain 74.6% of the total reported DL programs in Texas. It should be noted that these regions also have high percentages of Hispanic and ELL student populations and are situated in South Texas or on the border with Mexico.

DL Programs by Years of Implementation

According to the Lara-Alecio et al. (2004) report, 54% of the programs reported being within the p1anning year to three years of implementation. Forty-six percent of Texas' DL programs reported being within four to six years of implementation. This indicates that over half of the DL programs in Texas in 2003 were relatively new programs. Seventy-nine percent of the DL programs that were in the planning year in 2001-2002 reported forecasting a 50:50 model while 30.6% reported they were planning to implement a 90:10 model. Thirty-eight percent of DL programs in Year 1 of implementation reported having 90:10 models, and 61.8% reported implementing a 50:50 model.

The Focus of the Study: Dual Language Costs

Both the Center for Applied Linguistics' 2000 national study and Lara-Alecio et al.'s 2004 study have indicated a growing number of DL programs. Additionally, national and state professional conferences and research journals on bilingual and ESL education demonstrate an increasing interest in the research and implementation of DL programs. However, one significant feature that is absent from the literature on DL programs is the cost associated with implementation and maintenance of such programs. Information on funding of effective educational programs for ELLs is vital for all stakeholders, including policy makers and current and future DL program administrators.

While there has been some research into the costs of bilingual programs (Cardenas, Bernal, & Kean, 1976; Chambers & Parrish, 1992), the research team was unable to find studies concerning the costs associated with dual language programs above and beyond the costs of transitional bilingual programs. The previous research on bilingual costs provided insight into DL costs; however, DL costs may differ from costs associated with traditional, transitional bilingual programs due to some significant programmatic differences (i.e. inclusion of English speaking students and parents, additional curriculum and assessment materials for English speakers, additional staff development training costs, additional costs for staffing, teaching and management.)

Our study examined many of the same cost structures as the Cardenas study; however, we included certain funding costs that Cardenas et al. (1976) intentionally excluded due to the differing and specific nature of DL programs. For example, while the previous study chose not to include in-service training (staff development) because it is a general state requirement for all teachers, we, on the other hand considered DL program teachers to be in need of differentiated staff development in order to provide quality program support. After discussions with DL coordinators, it was confirmed that DL staff development was an additional funding need beyond the traditional, transitional bilingual staff development. In fact one administrator responded, "In this time of shrinking support for schools from tax based state funds, additional funds are needed from Title allocations to ensure the continued strength of DL programs. The subtle differences between DL and more traditional bilingual programs necessitate steady staff development and monitoring to ensure that the DL protocols are implemented in alignment with research-based designs."

We also decided to include textbooks as a regular DL operating cost because of the need for DL programs to supply Spanish textbooks for the native English speakers enrolled in each campus program. We specified that these reported costs should only include costs over and above the traditional, transitional

bilingual program costs. We chose not to include library costs for similar reasons; bilingual library resources, while still not adequate in many cases, have improved dramatically since 1976. It was also difficult to claim that DL library issues were any different from traditional, transitional bilingual library issues.

Since our study design was focused on DL campus costs, we did not include state agency administrative costs. However, we did include school administrative costs if the inclusion of a dual language program led to greater administrative costs than the transitional bilingual program. This differed from the prior studies as well, and it was impossible to ignore the expenses of a dual language program administrator, secretary, or parent involvement personnel and still offer a realistic cost analysis.

Central to conducting this survey were the key questions:

1. How much more does a DL program cost to operate than a traditional, transitional bilingual program?

2. Assuming the dual language class is not appreciably smaller than the typical bilingual classroom, what would be the additional management costs, staff costs, instructional costs, curriculum costs, equipment costs, material costs, assessment costs, staff development costs, and parent involvement costs?

These are complex questions on a number of levels. It was very important that we determined what, if any, differences in cost were related to program and teacher model. Finally, we wanted to determine how much of these additional costs were related to teaching model, program model, and program size.

Program size is an important variable due to the large disparity of pupil participation in the DL program from campus to campus. Obviously, a program with 20 students and one classroom will not require the managerial or support staff that a program consisting of over 600 students will require. A second issue is that of program composition and its effect on program cost. While a prototypical or ideal DL program consists of relatively equal numbers of native English and native Spanish-speaking students, many programs have very different ratios. Some DL programs have as much as a 99% Spanish speaking to a 1% English speaking population.

The relatively large number of Spanish-speaking children in many dual language programs also has a confounding effect on the results of the cost analysis. As the previous Lara-Alecio et al. (2004) study indicated, a large number of DL programs were found in South Texas which has on average a larger percentage of ELLs than native English speakers. These border districts are likely to be majority Hispanic, receive Title III funds for a large portion of their student body, and tend to be property-poor.

Methodology

Our study was developed as a descriptive study to provide an in-depth understanding of costs related to DL programs. Additionally, we included qualitative comments by the bilingual directors or campus administrators. These provided additional data for understanding the needs and reasons for costs as they currently exist in DL.

Definition of DL Program

For the purpose of this study, we defined a DL program as an instructional bilingual education model integrating both native English speakers and native Spanish speakers in content classes taught in both languages and with a goal of bilingualism and biliteracy for both language minority and language majority students. We required at least 10% English-speaking students for inclusion in the DL program. The state average is approximately 40% English-speaking students in DL programs (Lara-Alecio et al., 2004).

Participants

Participants for our study were purposefully selected. They included 304 identified bilingual directors and the 166 DL coordinators identified in the Lara-Alecio et al. (2004) study. E-mail information was collected from the Texas A&M University's Language Diversity Network (http://ldn.tamu.edu), Texas Two-way Consortium Website (http://texastwoway.org), the Texas Center for Bilingual/ESL Education (http://www.tcbee.org), from school district websites, and from a superintendent mailing list provided by the Texas Education Agency. Specifically 1042 superintendents received an e-mail as a notification of the survey. The e-mail requested that they direct the message to the bilingual director or the principal of the school should they be implementing a DL program. This was sent as a deliberate effort to determine any previously unidentified DL programs in the state.

Instrument

After conducting a comprehensive review of the literature related to bilingual and dual language program components, the research team with the aid of school finance personnel developed a DL 91- item campus survey. It was reviewed by an economist for accuracy and was pilot tested with bilingual administrators and DL teachers in both written and online format. A second, shorter survey of fourteen items was also developed for the district level. This survey was designed to briefly gather district information and was not used in the final cost-analysis. The surveys, in both formats, were deemed to have a high internal consistency (α=.90) and face validity.

Procedures

After completing our study of the number and features of DL programs in Texas (Lara-Alecio et al., 2004), we were provided with a contact list of administrators of DL programs in Texas. We utilized this list to send an e-mail invitation to participate in our survey. To ensure that we also reached those districts with DL programs initiated after our last survey, we utilized a comprehensive list of Texas district superintendents and on the first of October 2004 we sent an e-mail letter inviting participation. After two weeks a second e-mail invitation and phone calls were placed to the known 166 DL programs. During October 2004, 93 online responses were received representing a 56% response rate. Eighty-three of the surveys were determined to be complete (representing approximately 50% of the known total DL programs in Texas).

Results

Demographics

Ninety-three online DL cost surveys were completed in Fall 2004. After review by the research team, ten surveys were omitted due to missing data or after it was determined that the programs were not DL programs as defined for the purpose of this study. Table 1 reveals that 48 schools districts with DL programs completed the survey which included 83 DL programs consisting of 27 small-size programs, 31 medium-size programs, and 25 large-size programs. For the purpose of the study small DL programs were

comprised of 10-120 students; medium DL programs included 121-240 students; and large programs were designated as 240+ students. The researchers made these category distinctions based on the average number of students in DL programs that had one DL class per grade level (small program), two-classes per grade level (medium program), and three or more classes per grade level (large program). Over 67% of the responses utilized the 50:50 model. The 50:50 DL program model may be overrepresented in the cost analysis since the Lara-Alecio et al. (2004) study found that 53% of the state's DL programs were 50:50 models. However we hypothesize that it may also reflect the noted trend in the growth of 50:50 programs in contrast to 90:10 models.

Table 1

DL Survey Response Demographics

	Districts	Programs	Students	50:50	90:10	Small Programs	Medium Programs	Large Programs
Total	48	83	16,231	56	27	27	31	25

Note: 50:50 = 50:50 DL Program Model; 90:10=90:10 Program Model; Small Programs = 0-120 Students; Medium Programs = 121-240 Students; Large Programs = 240+ Students

Program age. Another distinctive feature of the reporting DL programs was the mean age of the programs by program size. Small programs reported a mean age of three years. Medium size programs were on average six years old, and large programs were on average almost five years into implementation.

Geographic region. In an attempt to ascertain that our responses were geographically representative of the known DL programs, we divided the state into four regions (Northeast, Southwest, East and South). We tabulated responses by Regional Education Service Center area (1-20). The majority of responses (45.12%) were in the Eastern Region which included the Houston and Dallas Metroplexes and the Southern Region (35.37%) which included the Rio Grande Valley. The third largest reporting region was the Southwest (15.85%) which included the El Paso area, another area of high concentration of known DL programs. The Northwest Region reported few programs (3.6%). These data reflect the regional distribution of DL programs found in the previous Lara-Alecio et al. (2004) study.

Grade levels. Figure 4 illustrates the grade levels of the reporting dual language programs. This figure is comparable to the grade level data from the Lara-Alecio et al. (2004) study. It is evident that the majority of the programs in the current study are concentrated at the early elementary grades. The number of programs in Grades 6-12 drops significantly. Note that only one high school program was included in the current study.

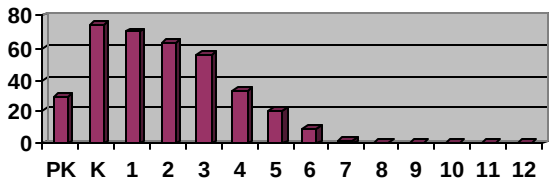


Figure 4. **Grade levels of reporting DL programs.**

Per-pupil Costs

Per-pupil costs were calculated by small, medium and large DL program models for start-up years, annually, and additional funds that the DL program administrators reported as needed to adequately support their current DL programs. The research team determined, after discussions with administrators of current programs, that there may be differences in start-up year costs and ongoing annual costs by size of program. also administers frequently reported that they do no have sufficient funds to maintain current program levels; therefore, another category, "additional needed funds," was requested from them these amounts. The average per pupil start-up costs and the average per pupil annual costs for the 83 DL programs reported are $512.00 and $525.00, respectively. Programs requested an additional $263.00 per pupil.

Table 2 reveals that smaller programs (0-120 students) were more costly per pupil to operate in all three categories: start-up, annual, and additional funds requested. Conversely, large programs were the most cost effective in all three categories. Large programs spent approximately 1/3 of the amount per pupil compared to small programs. We speculate that the reduced costs for large programs is due to minimized teacher and student recruitment for the program, shared resources, materials and administrative costs, reduced staff development and certification costs, larger percent of bilingual students in the district with associated Title III allotments, and a history of bilingual education programs and funding with opportunities to have previously purchased bilingual materials. Likewise, medium programs spent less than 1/2 the amount per pupil than small programs in all three categories.

Table 2

Mean Per-Pupil Costs for Start-Up, Annual and Additional Funds Needed by Program Size

Program Size	Start-Up	Annual	Additional
Small Program (n=27)	$825.00	$ 879.00	$568.00
Med. Program (n=31)	$399.00	$406.00	$209.00
Large Program (n=25)	$312.00	$290.00	$197.00

Note: Small Programs = 0-120 Students; Medium Programs = 121-240 Students; Large Programs = 240+ Students; Start-Up = Costs required to initiate program; Annual = yearly program costs; Additional = additional funds requested to maintain adequate program.

50:50 v. 90:10 Cost Differences

Since the Lara-Alecio et al. (2004) study found approximately equal proportions of 50:50 and 90:10 DL programs and since this current study found more 50:50 models in place, the research team was interested to discern whether there were cost differences associated with the two most common DL program models. Per pupil annual costs and requested additional funds are approximately equal for 90:10 ($389.00 and $246.00) and 50:50 ($388.00 and $238.00). There appears to be an insignificant difference in mean per pupil annual costs or requested additional funding associated with the two most common DL program models in Texas.

Teacher Models

After reviewing the literature and having discussions with DL administrators, we identified three distinct teacher arrangements: (a) two-teacher mixed, (b) one-teacher mixed, and (c) two-teacher separated.

Two-teacher mixed was the most common arrangement (n=39) and two-teacher separated was the least common (n=13). The two-teacher mixed model is one in which students are being served by two different teachers, one in Spanish, the other in English, for differing periods of the day or week. Native English and native Spanish speakers are mixed within the same class group. This model typically represents (minimally) two classes of students (approximately 40 students) which rotate between English and Spanish instruction in a "team-teaching" type situation in which planning, curriculum materials, and paraprofessionals are usually shared. The two-teacher mixed model is the least expensive model, which costs $297.00 per pupil annually and requests an additional $231.00 per pupil.

The one-teacher mixed, the second most common model (n=31), is one in which native English and native Spanish DL students are served by a single bilingual teacher instructing in both Spanish and English for different periods of the school day or week. Usually, this model requires hiring an additional teacher who is bilingual certified to serve as the DL teacher which may contribute to the expense of this design. This model was the most costly model reported with $522.00 annual cost and $241.00 additional fund per pupil.

The two-teacher separated model is one in which students are being served by different teachers, one in Spanish, the other in English, for differing periods of the day or week. Native English and native Spanish speakers are separated into different class groups, which are then switched for shifts in language of instruction and are occasionally integrated. This model is not the prototypical DL model since the integration of the two language groups is minimal. The two-teacher separated model (n=13) was the least reported and the second most expensive per pupil. Often such models require additional instructional support, such as an instructional aide, since students in this grouping are not mixed by language regularly and therefore are not able to provide one another with language clarifications, i.e., clarifying the English instruction with Spanish or the Spanish instruction with English (Lara-Alecio & Parker, 1994). Additionally, this model does not foster collaborative planning and sharing of resources. These factors may contribute the significant difference in cost between the two-teacher mixed model and this model that reported an annual cost of $448.00 per pupil and additional fund requested of $277.00 per pupil.

Cost Categories

The survey requested information on 12 categories associated with dual language programs. Respondents were asked to determine mean start-up, annual, and additional requested costs across 12 cost categories above and beyond their expenditures for traditional transitional bilingual programs. The categories were: managerial, staff, instruction, staff development, Spanish curriculum, English curriculum,

assessment, equipment, recruitment, public relations, parental involvement, and other materials. Table 3 presents a brief explanation of each category.

Table 3

Categories of Costs Associated with DL Programs

Category	Explanation
Managerial costs	Include costs associated with professional staff needed to operate the DL program such as a Dual language coordinator. This managerial staffs were solely dedicated to the dual program.
Staff costs	Are associated with staff needed to operate the DL program such as a clerk/typist, secretary, parent liaison or/and assessors.
Instructional costs	Include costs associated with instructional staff dedicated to the dual program that otherwise would not be on campus such as teachers, paraprofessionals, tutors, etc.
Staff Development/	Are for both staff and teachers focused on dual language programs such as site visits, conferences, travel, registration, on-site presentations, etc. over and above the required five state days.
Curriculum material costs	Are for Spanish speakers learning English (i.e. leveled readers, texts, videos, audio books, computer
Curricular material costs	Are for English speakers learning Spanish (i.e. leveled readers, texts, videos, audio books, computer software, etc.) over and above those needed for the traditional bilingual classroom.
Assessment material costs	Are for English and Spanish speakers over and above those needed for the traditional bilingual or
Equipment costs	Are necessary to the proper functioning of the program (for example: card readers, listening
Recruitment costs	Are included for both students and teachers (newspaper, radio, television, meetings, and flyers).
Public relations costs	Includes items such as videos, brochures, and meetings. These costs were over and above the typical school-home communications.
Parental involvement costs	Includes parental instructional or orientation programs during or after school. These include L2
Other material costs	Includes unanticipated costs reported by programs.

Start-up costs. Table 4 details the mean start-up costs across the 12 categories for small, medium and large programs. The largest costs for all three DL groups were associated with managerial costs. While many may believe managerial costs to be overstated, one principal indicated, "While the program can be sustained at an adequate level, the loss of managerial and support personnel will impact the program's effectiveness. Once the additional funding ends, the bilingual department which already has a huge case load will have to consider ways to maintain positions." The least costs across the three groups were associated with recruitment for both students and teachers. All three groups reported start-up costs associated with instruction and staff development. Instruction costs were similar for medium and large programs, and staff development costs were similar for small and medium programs. Large programs needed over $18,000 for start-up training and staff development.

Table 4

Mean Start-up Costs by Program Size above Typical Transitional Bilingual Program Costs

Costs Category	Small	Medium	Large
Managerial	$14,333.00	$19,616.00	$27,800.00
Staff	$3,148.00	$7,823.00	$9,409.00
Instruction	$1,548.00	$9,633.00	$9,400.00
Staff Development	$6,986.00	$6,557.00	$18,113.00
Spanish Curriculum	$3,480.00	$6,513.00	$20,499.00
English Curriculum	$3,572.00	$6,352.00	$12,297.00
Assessment	$1,522.00	$1,447.00	$5,060.00
Equipment	$1,389.00	$1,961.00	$6,339.00
Recruitment	$178.00	$911.00	$790.00
Public Relations	$946.00	$484.00	$1,104.00
Parental Involvement	$744.00	$2,695.00	$5,193.00
Other Materials	$667.00	$758.00	$2,542.00
TOTAL	$38,513.00	$64,750.00	$118,546.00

Note: Category Costs: 12 major cost categories; small=small DL program; medium= medium DL program; large=large DL program.

Costs associated with native English speakers. Two areas of concern for funding in DL programs are costs associated with serving the native English speakers in the DL program. State or federal Title III allotments cannot be used to purchase materials or fund instruction for non-ELL students. One principal stated, "The district received Title VII funds and those funds were used to assist with start-up costs. State funds are needed to pay for additional Spanish textbooks for each of the non-ELL students in all content areas. This is one of our school's biggest financial concerns. If native English speaking students are served in DL programs, the state should support the purchase of textbooks for the non-ELLs." The survey indicated that DL Programs incurred start-up Spanish curriculum costs for the native English speakers on average of $3,480 for small programs, $6,352 for medium programs and $12,297 for large programs. Additionally, DL programs may need additional assessment materials for the native English speakers. Small programs reported assessment start-up costs of $1,522; medium programs reported assessment start-up costs of $1,447, and large programs reported assessment start-up costs of $5,060.

The survey also found that in general, the average annual costs and the costs per pupil increased as the percentage of native English speakers increased. In programs with 10-30% native English speakers, the average annual costs were $62,715.64; and the costs per pupil were $326.37, compared to programs with 30-49% native English speakers which cost $76,750.69 annually and $445.36 per pupil, or a difference of $119 per student. For programs with 50% or above native English speakers, the average annual costs were reported as $90,574.36 and costs per pupil $413.81. These data represent a 36.5% increase of costs associated with service to increased numbers of native English speakers. The increasing cost per pupil was

predicted since the cost data calculations were based on expenditures over and above the traditional transitional bilingual program (native English speakers are not included in the transitional bilingual classrooms). Since State ELL funds cannot be used for purchases for this population of students, any additional resources needed for the English speakers in the DL program must come from local funds.

Annual costs. Notably in Table 5, the largest annual cost category for medium and large programs is administrative/managerial costs. For small programs, the largest annual cost category is instruction. The total annual costs of a small program approaches the total costs associated with a medium program.

Table 5

Mean Annual Costs by Program Size above Typical Bilingual Program Costs

Costs Categories	Small	Medium	Large
Managerial	$15,907.00	$16,626.00	$23,990.00
Staff	$3,444.00	$8,355.00	$10,037.00
Instruction	$22,185.00	$15,570.00	$12,451.00
Staff Development	$4,537.00	$7,115.00	$20,529.00
Spanish Curriculum	$2,676.00	$4,477.00	$15,120.00
English Curriculum	$2,787.00	$4,517.00	$10,058.00
Assessment	$1,354.00	$1,381.00	$4,200.00
Equipment	$815.00	$2,645.00	$6,059.00
Recruitment	$237.00	$629.00	$728.00
Public Relations	$328.00	$1,203.00	$838.00
Parental Involvement	$752.00	$2,966.00	$3,533.00
Other Materials	$815.00	$445.00	$2,426.00
TOTAL	$55,837.00	$65,929.00	$109,969.00

Note: Category Costs: 12 major cost categories; small=small DL program; medium= medium DL program; large=large DL program.

Costs by teacher model. Table 6 reports costs associated with the three teacher/instructional models: (a) two-teacher mixed; (b) one-teacher mixed; and (c) and two-teacher separated. Notably, the two-teacher mixed model reports the smallest amount of annual expenditures; however, the two-teacher mixed model was only slightly less expensive than the two-teacher separate model. The two-teacher mixed model

was the least expensive model per pupil. The difference between the two-teacher mixed and the two-teacher separated models in costs appears to be in the areas of managerial support and instructional categories. The most costly teacher model is the one-teacher mixed model with the amount totaling nearly $20,000. The one-teacher mixed model reported significantly more cost than the other two models in that areas of: curriculum, assessment, equipment, recruitment and instruction. This is reasonable since one extra teacher would have to be employed to serve the program.

Table 6

Mean Annual Funds by Teacher Model above Traditional Transitional Bilingual Program Costs

Cost Category	2 Teachers Mixed	1 Teacher Mixed	2 Teachers Sep.
Managerial	$17,928.00	$17,484.00	$23,342.00
Staff	$6,229.00	$8,742.00	$6,846.00
Instruction	$14,366.00	$18,941.00	$18,884.00
Staff Development	$11,289.00	$10,207.00	$7,659.00
Spanish Curriculum	$6,150.00	$9,819.00	$3,446.00
English Curriculum	$3,360.00	$9,819.00	$2,408.00
Assessment	$1,822.00	$3,389.00	$635.00
Equipment	$2,230.00	$4,339.00	$2,615.00
Recruitment	$426.00	$813.00	$177.00
Public Relations	$1,029.00	$653.00	$515.00
Parental Involvement	$1,804.00	$3,710.00	$1,169.00
Other Materials	$1,653.00	$710.00	$769.00
TOTAL	$68,286.00	$88,626.00	$68,465.00

Note: Category Costs: 12 major cost categories; Two-Teacher Mixed= One Spanish speaking teacher and one English speaking teacher "team teaching" two mixed groups of native English and Spanish DL students. One-Teacher Mixed= One bilingual teacher serving one class of DL students (mixed group of native English and Spanish speakers). Two-Teacher Sep= Two-teacher separated serving native English and Spanish speakers in separate classrooms. The two language groups are separated.

Annual cost per size of program.

The next analyses depict cost category breakdowns as a framework of annual costs in terms of small, medium and large districts. Figure 5 illustrates a comparison of the 12 cost categories by size of program. It shows that for small programs, the largest category was associated with instruction. In fact, instruction and managerial costs represented over 73% of the total expenditures. For DL programs of medium size, instruction, staff and managerial cost 71% of the total expenditures; while staff development costs were 11% of the total budget. For large DL programs nearly one quarter of annual costs were associated with Spanish and English curriculum materials. Instructional costs were lower than that of medium and small programs whereas staff development costs were higher than those of medium and small

programs. We must caution that this figure is presented by total program costs in each category and not by per pupil or percentage of total costs. Large programs could be expected to have more expenditures such as curricula, staff development, and managerial due to increased numbers of students and staff.

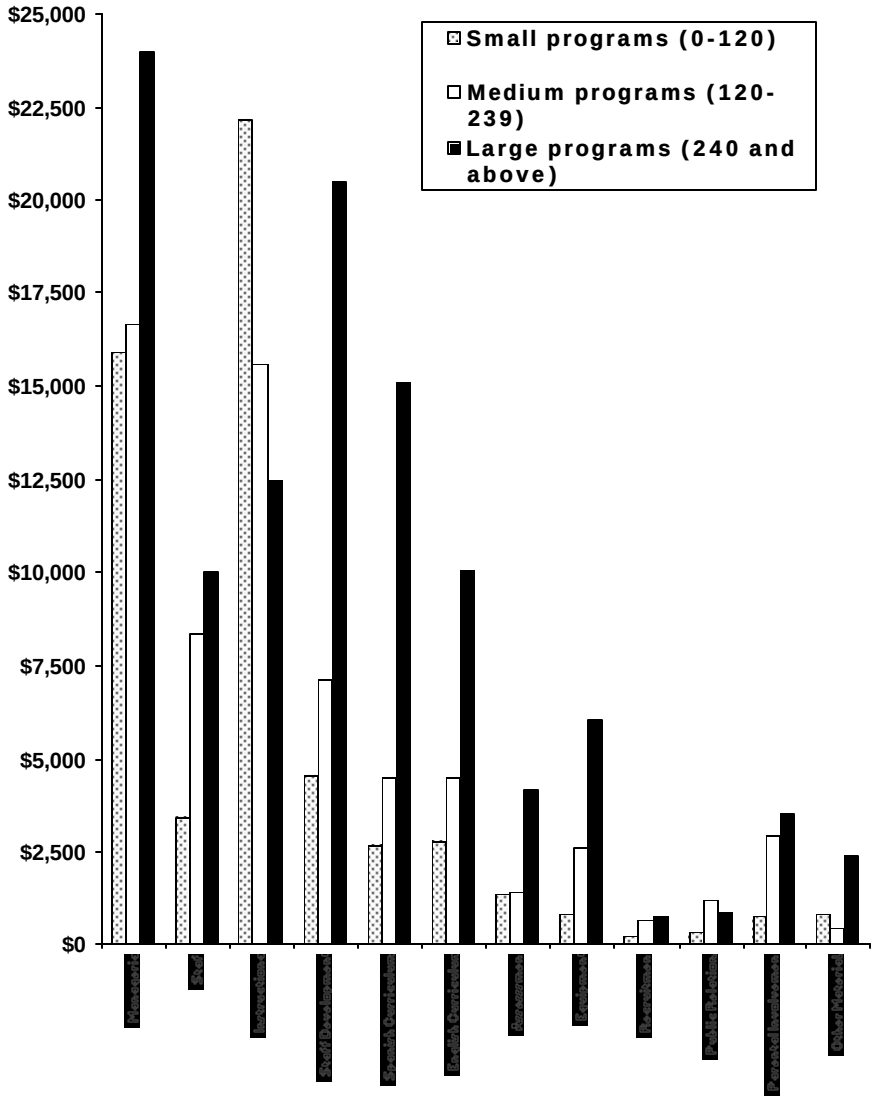


Figure 5. **Percentages of annual costs per category by program size.**

Middle and High School Programs

There are few known middle or high school DL programs in the nation or Texas. We have only been able to identify 11 such programs in Texas. Only one high school program responded to the DL cost survey. We will be seeking additional data from these programs to provide better insight into the costs associated with secondary DL programs. The one high school that completed the survey reported a per pupil cost of $358 per pupil. More complete secondary data will be sought in a follow-up study.

Federal Funding

With the inception of the No Child Left Behind Act (2001), bilingual education was mandated. Prior to 2001, there was what McDonnell (2004) has termed capacity-building policies. Those policies provided for additional funding to enhance local district efforts, rather than mandated policies for bilingual education. Many school districts applied directly to the U.S. Department of Education for supplemental funds such as those that supported start-up and continued implementation for dual language programs. Under this funding formula, funds could be used for native English speakers not eligible under the current federal flow-through funds under the Title III allotment. Lara-Alecio et al. (2004) determined that DL programs in Texas were positively impacted by these USDOE capacity-building funds.

Due to their typical three to five-year funding cycles, many of the current DL programs are either out of federal monies or soon will be. Our current study indicated that 88% of large programs and over half of small (51.8%) and medium (54.8%) programs have received federal funds. Overall, 53 of the campus' DL programs (63%) received federal funding with an average award of $498, 874 over a three to five year period. This number includes 22 large DL programs which may skew the data upward. Only three of the large programs did not report receiving federal funds. The significant federal support for DL programs contributed to the growth of DL models in Texas and calls into question the sustainability of these programs should an alternate funding source not be found. One dual language coordinator remarked, "Although we could maintain the program due to an already established school culture and commitment, we could not maintain the high expectations we have set without funding for personnel. The federal funds we received paid for a school coordinator, bilingual aides, a parent liaison, consultants, and tutors. These positions supported stronger recruitment efforts, instructional and parental support. The aides were able to support classroom teachers during the school day, and tutors provided small group instruction. The quality of our program overall increased greatly with these components."

Summary and Recommendations

DL programs are viable bilingual models that promote bilingualism and biliteracy for both language majority and language minority students; however, our current study makes no link between dual language program costs and program effectiveness related to such bilingualism and biliteracy. Based on the cost analysis study, the following are recommendations.

1. Our findings are based on actual expenditures above and beyond the traditional transitional bilingual education program. The data indicated that the average per pupil costs across programs sizes was $525, so for a 24-student classroom, the estimated additional funds would be $12,600. For a 24-student classroom under the two-teacher mixed model the costs for funding a DL program above and beyond the traditional, transitional bilingual program is $7,128. The reduced costs of the two-teacher mixed model plus the additional benefits of "team-teaching," curriculum planning and sharing, and peer language clarifications lead us to recommend the two-teacher mixed model, whether it is in a 50:50 or a 90:10 arrangement.

2. A recurring theme within the data was the lack of funding for native English speakers who represent nearly 40% of the students served in DL programs in Texas. The need for additional curriculum and assessment materials in Spanish for these students is a financial challenge for these districts, many of which are low SES, Title I campuses. As reported, as the percentage of native English speakers increases in a DL program so does the costs per pupil. In fact, a 36.5% local expenditure increase was detected for programs with larger percentages of native English speakers. We recommend that the State determine alternative funding avenues for supporting these additional student costs related to serving the English speaker in a bilingual program.

3. Additionally, the State should reflect on the volume of programs that were fostered under capacity-building federal funding initiatives and that now are facing a critical stage as this additional program funding has been depleted. The data revealed immediate concerns from campus and district administrators about sustaining adequate funding levels that would maintain program integrity. The State might consider a competitive grant process to pilot new programs and to sustain existing ones including middle school and high school programs, so that the intended goal of K-12 DL programs can be better realized. We recommend that new programs funded under such a competitive grant process begin at Kindergarten adding one grade level per year. We also recommend that programs should be maintained at least through middle school.

4. Although not studied in our current research, we have a related recommendation to the two-teacher mixed model, and that is to develop a dual language teacher certification process allowing for testing in a teacher's native language thereby strengthening both language components and potentially increasing the number of certified dual language teachers. Bilingual and ESL teachers are in critical shortage in Texas and the question of how to attract and retain certified bilingual teachers is paramount (Lara-Alecio, Galloway, Irby & Brown, 2003). The state might consider assisting local districts with the increasing costs associated (a) with bilingual and ESL teacher stipends in dual language programs, (b) with offering additional loan forgiveness programs or (c) state bonuses/stipends for individuals willing to serve in districts with extreme shortages. Increasing the numbers of students that graduate from Texas' schools fully biliterate and bilingual may have the potential over time to significantly address the bilingual teacher shortage as well as other employment areas where bilingual skills are required.

5. The DL program can serve the English speakers or Spanish language learners (SLL) and the Spanish speakers well by allowing them to obtain their academic proficiency in Spanish by the time they reach junior high. At such time, they can begin advanced placement Spanish credit. Dual language and foreign language programs can work collaboratively to ensure the foreign language TEKS are included in the curriculum between grades PK-5.

6. Our study provided insight into the actual start-up and annual costs by program size over and above transitional bilingual program costs; we recommend for new, small programs that the average start-up cost allocations should minimally approximate $39,000 and annual cost allocations should minimally approximate $56,000 (or $879 per pupil).

7. We found the lowest costs per pupil were associated with the following: (a) Larger DL Programs and (b) Two-Teacher Mixed Model Programs. No real cost difference was detected between 50:50 and 90:10 DL program designs.

8. One of our recommendations is to conduct an analysis of effectiveness of DL programs related to costs. Since there is a known sample of dual language programs, state achievement data could be drawn on that sample and compared to the associated costs.

9. Another recommendation is to perform a follow-up study of programs that received federal funding to determine the level of sustainability.

Final Remarks

The study results are timely related to the costs of educating the nearly 16,500 students represented in this sample. Dual language programs can assist students in becoming fully biliterate citizens of Texas who can serve as a unique linguistic, cultural, and economic resource much needed for the constructive future of our State and Nation.

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