Spanish Achievement in a Maintenance Bilingual Education Program: Language Proficiency, Grade and Gender Comparisons*

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Abstract

The purpose of this study was to examine the mediational effects of a students fluent or limited Spanish proficiency and gender across selected grade levels on Spanish achievement in a maintenance bilingual education (MBE) program. Reading and mathematics achievement for grades 1-8 were examined for 676 subjects, while achievement in social studies and science across grades 2-8 was investigated for 518 subjects. The overall results indicated the following: (1) fluent Spanish proficient (FSP) subjects consistently outperformed their limited Spanish proficient (LSP) counterparts for each of the four subtests; (2) girls achieved significantly higher reading scores than boys, but no gender differences were noted for the other three subtests; and (3) 16 of the 18 grade mean scores were equal to or significantly above the Texas norms of *La Prueba*, while two were significantly below that level.

Introduction

Several scholars (Cummins, 1989; Medina, 1991; Moll, 1992; Wong Fillmore & Valadez, 1985) have supported the importance of investigating whether dual language instructional models such as additive maintenance bilingual education (MBE) programs produce adequate levels of academic growth in the native language. Cummins (1989) dual hypotheses theoretical framework served to illuminate the sequential importance of developing and maintaining strong native language proficiency to the later emergence of comparable proficiency in English. Wong Fillmore and Valadez (1985) concluded that in additive MBE programs, the key to successful development of full literacy and computational skills in the students' two languages is the use of his or her native language for early instruction. Moll (1992) noted the deficit views about

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language-minority children perpetuated by research emphasizing how well these students acquire English rather than a more expansive vision that might include their development of bilingualism and critical funds of knowledge from their sociocultural communities. Research in this area seems to suggest a clear lack of systematic efforts to conduct empirical studies inclusive of educationally relevant parameters such as native language achievement across several grade levels, native language oral proficiency, and gender. Since only one study to date (Medina, 1991) has exclusively examined native language achievement in an MBE program, further scholarly inquiry of this bilingual education research concern is needed.

Within the context of such a need, the present investigation was undertaken to examine the mediational effects of native language proficiency of male and female students across selected grade levels on Spanish academic achievement in a maintenance bilingual education program. Native language proficiency as examined in this study refers to the students' fluent or limited Spanish proficiency. Spanish academic performance of students in grades one through eight was investigated for reading and mathematics, and students in second through eighth grades were tested for social studies and science achievement. More specifically, the study was aimed at obtaining answers to three fundamentally important questions related to variations in learner characteristics for Spanish language proficiency, gender, and grade level as they impact on Spanish academic outcomes in reading, mathematics, social studies, and science. These questions are: (1) How do fluent and limited Spanish proficient students in an MBE program compare in their native language academic achievement?, (2) Are there gender differences in Spanish achievement levels for students exposed to the MBE program?, and (3) How do MBE program participants compare across grades one through eight and two through eight in their academic performance in Spanish?

Prior to addressing these questions, the value of native language oral proficiency to academic achievement will be discussed briefly.

Native Language Oral Proficiency and Academic Achievement

Bilingual education theoreticians and researchers (Cummins, 1989; Hakuta, 1986; McLaughlin, 1985; Snow, 1992) have suggested that developing high levels of native language proficiency

facilitates acquisition of a second language. This reciprocal language-learning process means that MBE students' knowledge of their native language assists them in acquiring English, and the acquisition of English as their second language aids in further development of their first language (McLaughlin, 1985). According to Snow (1992), it is precisely this high-quality linguistic environment that makes even poor bilingual programs more successful in promoting rapid English acquisition than excellent English-as-second language or submersion settings. Optimal functioning in both languages requires exposure to a full range of experiences in each. Consequently, evaluation of the quality of these dual-language programs for language-minority children is crucial.

In a study by Medina and Escamilla (1992), Mexican-American students who were fluent (FSP) and limited-Spanish proficient (LSP) and limited-English proficient (LEP) participated in a three-year (grades K-2), primarily Spanish-language MBE program As a result, these subjects acquired significant levels of English. In another study, Escamilla and Medina (1993), reported that two groups of LSP/LEP subjects in a similar K-2 MBE program enhanced their Spanish and English significantly. A grades 1-8 cross-sectional study of a school districts MBE program found Spanish reading and mathematics achievement to be at or above regional Texas norms for 11 of 12 comparisons for fluent and limited Spanish proficient LEP Mexican Americans. Although these two groups were not compared by native language fluency, a visual review of their academic performance suggested that fluent Spanish speakers' achievement means were higher in all instances (Medina, 1991).

In a closely related bilingual/immersion study by Lindholm and Alcan (1991), the relationship between bilingual proficiency and reading and mathematics academic achievement in English and Spanish were examined for first through fourth grade program participants. The researchers hypothesized that highly proficient bilingual speakers would score higher than medium- proficient bilinguals who would, in turn, outperform the low-proficient bilinguals in academic achievement in both languages. Spanish reading results generally followed this trend across grades. Spanish mathematics outcomes resulted in the same tendency for grades one, two, and four. These study results provided clear evidence that highly proficient bilingual speakers are at an advantage in their

Spanish reading and mathematics performance over less proficient students.

Other scholars (de la Garza & Medina, 1985; Medina & de Ia Garza, 1989; Saldate, Mishra, & Medina, 1985; Willig, 1985) have also reported Spanish achievement outcomes in transitional bilingual education (TBE) and MBE programs. Spanish-speaking, Mexican American children in a first through third grade TBE program performed at grade level across those three years for Spanish reading and mathematics achievement while their Spanish vocabulary academic performance reached national norms for second and third grades (de la Garza & Medina, 1985). Medina and de la Garza (1989) reported Spanish reading performance to be at national norm levels for grades 1, 2, and 3 within a TBE program. By grade 3, MBE program participants (grades 1-3) were at national norms for Spanish reading in another longitudinal study (Saldate, Mishra, & Medina, 1985). Willig's (1985) meta-analysis study found significant positive effects related to native-language achievement for bilingual programs in the areas of reading, mathematics, and social studies.

The literature discussed in this section has addressed the positive effects of developing native language oral proficiency on academic achievement and has served to demonstrate the critical need for further scholarly inquiry. The research parameters of the present study examine possible mediational effects of native-language proficiency and gender on Spanish achievement in an MBE program, across selected grades, thereby contributing to an area where systematic inquiry has been lacking.

Method

Sample. Study subjects were selected from four junior high schools (grades 7-8) and 24 elementary schools located in a large (55,000 students), urban school district with a 33% Mexican American student population in Southern Arizona. The subjects represented all MBE program participants with Iii Prueba Spanish reading, mathematics, social studies, and science achievement scores (see instrumentation section), as well as Spanish Language Assessment Scales (*SLAS*) (De Avila & Duncan, 1983a) levels of oral proficiency (1986-1987) (see Table 1). Approximately three-quarters of all students attending the 28 schools were receiving free lunches, suggestive that their SES levels were quite low.

Table 1
Number of Students by Spanish Language Proficiency Levels and the SLAS Means for Grade Groups

Grade		SLAS Levels					
Groups	n	1	2	3	4	5	Mean
1	158	6	5	33	57	57	3.97
2	169	2	3	20	48	96	4.38
3	121	0	0	11	33	77	4.55
4 Includes 5	107	1	0	2	17	87	4.77
5 Includes 6,7,8	121	3	3	11	73	31	3.87

Note: *SLAS* is the Spanish version of the LAS.

Reading and Mathematics. The effects of gender, grade, and native (Spanish) oral language proficiency on reading (see Table 2) and mathematics competence (see Table 3) were examined for grades 1-8 for 676 subjects. The MBE program participants in this study consisted of 338 boys and 338 girls. FSP (*SLAS* levels 4 and 5) subjects numbered 576 with an *SLAS* mean of 4.60, while their less fluent LSP (*SLAS* levels 1, 2, 3) counterparts totaled 100 and their *SLAS* mean was 2.65. Grades one ($\underline{n}$ = 158), two ($\underline{n}$ = 169), and three (n = 121) included first, second, and third grades, respectively, while grade cluster four ($\underline{n}$ = 107) included grades four and five, and grade cluster five (n = 121) included sixth, seventh, and eighth graders.

Social Studies and Science. The same three mediational effects were examined for mastery of social studies (see Table 4) and science (see Table 5) by 518 students in grades 2-8. Subjects included 261 boys and 257 girls, of whom 462 were classified as FSP (*SLAS* $\underline{M}$ = 4.63) and 56 as LSP (*SLAS* $\underline{M}$ 2.61). Grades two ($\underline{n}$ = 169) and three ($\underline{n}$ = 121) consisted of second and third grades, respectively, while grade cluster four ($\underline{n}$ = 107) included

fourth and fifth grades, and grade cluster five (n = 121) included grades six, seven, and eight.

The School District. The school board and community of this Southwestern educational setting supported the establishment and implementation of its MBE program. In 1969, ESEA Title VII funding provided the first bilingual elementary programs in two schools. Twelve years later, and three years before Arizona passed a mandatory bilingual law in 1984, the school district's board unanimously supported a K-12, additive MBE policy (Medina & Sacken, 1988; Sacken & Medina, 1990). This district-level policy passed in 1981, at a time when state law allowed only voluntary, nonmandated TBE programs in K-8, and any participating student was limited to four years of services. The school district's community supported maintenance and use of Spanish. Spanish-speaking church services and the existence of extensive Spanish television programming, as well as four Spanish radio stations, were indicators of this community support. Further support was evidenced by the election of two Mexican American bilingual education advocates to the five-member school board.

Instrumentation

The instrument used to measure Spanish reading, mathematics, social studies, and science achievement was the *La Prueba Riverside de Realización en Español (La Prueba)* (Cole, Trent, & Wadell, 1984a). The following reasons for the district's selection of this test also comprise a sound rationale for its use in this study. This state-approved instrument, one of two available in Spanish at the time, was judged by the school districts bilingual administrator to be more similar in content and format to the state-mandated English achievement test. Furthermore, its Texas norm group was also assessed to be more like the Arizona school district's pupils than the other test's Mexican norming population (Escamilla, 1988). The Texas norm group population was chosen because of their average and above-average oral language proficiency in Spanish to allow for more appropriate testing of the four academic areas examined in this study (Cole, Trent, & Wadell, 1984b).

These Southwestern regional norms may be more appropriate and generalizable than more generic national norms. Texas school districts were selected based on their large populations of Hispanic students and the presence of bilingual native language programs. Further, 70% of all Hispanics are concentrated in the five

Southwestern states of Arizona, California, Colorado, New Mexico, and Texas (Orfield, Monfort, & George, 1987). Similar to Arizona, the majority of Hispanics in Texas are of Mexican-American background. In addition, a large proportion of all Hispanics, 25%,. reside in Texas providing a more similar norm group for Arizona than would a 50-state, national Hispanic norm group which includes a more diverse population.

The state-approved, short form of the *SLAS* was used to classify the two linguistically different groups of subjects. Subscale scores on the *SLAS* were converted to five oral language proficiency levels. FSP students were denoted as levels four or five, while levels one, two, and three were considered LSP. The widely used *SLAS* has been found to be valid and reliable with LEP children (De Avila & Duncan, 1982; 1983b) and should prove adequate for use in this study.

Instructional Program

This district-level additive MBE program was found in four junior high schools and 24 elementary sites. These 28 program sites were monitored by the district's bilingual education department every two years to determine their degree of adherence to the school systems well-established MBE model. These two-day monitoring visits by six member teams included pre- and post- conferences with school site teachers and administration. Reviews of teachers lesson plans and classroom observations were used to ascertain whether the district MBE model, which emphasized alternating L_1 (native language) and L_2 (English), maintaining L_1 time allotments by grade, and ensuring equal status to L_1, was clearly evident. A post-conference was held on the second day, and a subsequent formal written report was provided a week later. These evaluative functions were intended to highlight a schools program strengths as well as weaknesses.

The MBE reading, mathematics, social studies, and science curriculum followed all state and district guidelines used in their monolingual English classroom. L_1 time allotments for each grade were designated by the district as follows: grade K, 80%; grade 1, 75%; grade 2, 70%; grade 3, 65%; grade 4, 60%; and grades 5 through 8, 50%. LEP student classroom distribution was not to exceed two-thirds, and the goal was equal distribution with English-proficient students. Fluent English-speaking peer interaction models

were considered essential to the successful acquisition of English by the LEP students (Tucson Unified School District, 1984). District policy regarding system-wide single basal series adoption (K-8) in reading, mathematics, social studies, and science facilitated and enhanced quality of instruction in those four academic areas.

To ensure that all MBE classes in the district were staffed by the most-qualified bilingually proficient (Spanish/English) teachers, the district-level bilingual program director was solely responsible for conducting a comprehensive and rigorous process of recruitment, interviewing, hiring, and school-site placement. This process was guided by new state legislation and state school board policy. At the time of this study (1986-1987), the Arizona bilingual law was in its third year of implementation; however, teachers in these classes were not required to possess bilingual education endorsements until 1987-88 (see 15 Arizona Revised Statutes, sec. 751 et seq.). Endorsement required that bilingual teachers demonstrate Spanish proficiency by passing the state classroom proficiency exam and increased the unit requirements from 15 to 27 hours of coursework. Teachers who received certification prior to 1987-88 were exempted for these new requirements and were endorsed for native-language instructional settings (Arizona Department of Education, 1989). For teachers seeking certification, provisional bilingual education credentials were issued for one year. Provisional endorsements could be renewed for two additional years if six hours of specified courses were completed each year.

A district goal for recruiting, hiring, and placing MBE teachers emphasized attracting candidates with strong proficiency in Spanish as well as English. In 1986-87, one year prior to mandated implementation of the new bilingual law, approximately 60% of grade one through eight bilingual classroom teachers in this district were fully credentialed, and 18.5% held provisional bilingual endorsements. The remainder were not yet certified for native-language settings (Arizona Department of Education, 1988). These noncertified (21.5%) teachers had demonstrated to the district bilingual director through rigorous bilingual interviews and screening that their Spanish and English proficiency was sufficient to be placed in MBE classes. As a condition of employment, noncertified teachers were also required to seek provisional bilingual endorsement when qualified. As a result of these precautions, all grade one through eight bilingual teachers were adequately proficient to enhance Spanish academic achievement. As a point of

comparison, only 6% of MBE classrooms (K-12) statewide were taught by fully credentialed teachers in 1986-87, while 2.5% held provisional endorsements and 91% were not certified. Combined MBE and transitional bilingual programs in districts other than the one examined in this study were staffed by 32% fully endorsed bilingual teachers, 5% provisionally certified teachers, and 63% noncertified staff.

District policy also allocated each grade one through eight MBE class with two hours of bilingual teacher aide assistance per day. These aides possessed the following qualifications: 27% had associate of arts degrees and 63.4% possessed high school diplomas or GEDs, while 9.6% lacked these qualifications.

In the primary grades (1-3), the instructional focus was on initial concept development in reading, mathematics, social studies, and science. These initial concepts in the four subject areas were taught in Spanish, the students primary language. Eventually, subject area instruction alternated daily, weekly, or monthly between L_1 and L_2, dependent on the language strengths of the student (Tucson Unified School District, 1984).

The intermediate grade's (4-6) instructional focus across the same four subject areas was now on concept maintenance. Development of more complex academic learning also began in this grade span. An additional allocation of time was provided for concept reinforcement, although the time for native language instruction decreased from 60% to 50%. L_1 and L_2 continued to be used in an alternating manner on a weekly or monthly basis.

The junior high grades (7-8) instructional focus included two periods of language arts (one English, one Spanish). Additionally, study subjects took required mathematics classes (general mathematics or pre-algebra) where L_1 instruction alternated by semester, by quarter, or by unit. Bilingual social studies or bilingual science was offered to all subjects, contingent upon available staff at the school. Staffing also determined bilingual elective courses offered at the four sites.

Data Analysis

Procedure. At the end of the 1987 spring semester, all MBE subjects (grades 1-8) were administered *La Prueba*, given by the school district to all its bilingual education program participants. Spanish reading, mathematics, social studies, and science subtests

were used for analysis. Standard scores on these subtests were delineated as Normal Curve Equivalents (NCEs: M = 50, SD = 21.06), facilitating comparison of subjects academic performance to the Texas norms of the test.

Analysis. For purposes of analysis, SLAS proficiency levels were partitioned to create two separate groups: one reflecting limited Spanish (LSP) oral proficiency (*SLAS* levels 1, 2, and 3) and the other representing fluent Spanish (FSP) oral proficiency (SLAS levels 4 and 5). Grade effects were analyzed for each of the four subtests. The same subjects (in grades one through eight) were evaluated for each subtest (i. e., Spanish reading, mathematics, social studies, and science) with one exception. Social studies and science subtests were not administered to first-grade students. However, due to an inadequate number of these subjects at some grade levels from 4 to 8, combining these grades into two grade clusters was necessary.

Identical analyses of variance were calculated using gender (2) x *SLAS* (2) x grade (5) as independent variables and either Spanish reading or Spanish mathematics NCE scores (*La Prueba*) as dependent variables. Similar analyses of variance were generated using gender (2) x *SLAS* (2) x grade (4) as independent variables and either Spanish social studies or Spanish science achievement NCE scores (*La Prueba*) as dependent variables. Tukey post hoc tests were used to interpret significant main effects for grade, while Bonferroni t post hoc analysis was used to identify significant mean differences for *SLAS* by grade interactions. Results from these analyses are summarized in Tables 2-5.

Results

Analysis of La Prueba Reading Data. As shown in Table 2, significant main effects for Spanish reading achievement were evident for *SLAS* (MSe = 462.51, F_1, 657 = 27.40, $p < .001$), gender (MSe = 462.51, F_1 657 = 9.64, $p < .01$), and grade (MSe = 462.51, F_4, 657 = 11.76, $p < .001$). Additionally, a two-way interaction (MSe = 462.51, F_4, 657 = 2.40, $p < .05$) was evident for *SLAS* by grade.

Table 2
Spanish Reading Achievement of Sampled Subjects Across Proficiency, Grade, and Gender

Group	n	M	SD	F-ratio
Proficiency				27.40***
FSP	576	51.74	22.36	
LSP	100	42.93	22.25	
Grade				11.76***
1	158	56.87	22.15	
2	169	53.82	21.71	
3	121	46.01	22.99	
4[a]	107	43.94	20.17	
5[b]	121	47.47	20.28	
Gender				9.64**
Boys	338	47.82	22.91	
Girls	338	53.05	21.90	
Proficiency x Grade				2.40*
FSP Grade 1	114	58.25	24.27	
FSP Grade 2	144	55.85	22.12	
FSP Grade 3	110	48.67	22.05	
FSP Grade 4[a]	104	44.48	20.07	
FSP Grade 5[b]	104	49.39	20.21	
LSP Grade 1	44	53.27	23.73	
LSP Grade 2	25	42.12	14.68	
LSP Grade 3	11	19.36	13.31	
LSP Grade 4a	3	25.33	16.80	
LSP Grade 5[b]	17	35.71	16.87	

Note: Descriptive data for only significant main and interaction effects have been reported. FSP is fluent Spanish proficient and LSP is limited Spanish proficient subjects. [a]Grade 4 combined grades 4 and 5. [b]Grade 5 combined grades 6, 7 and 8. *p < .05, **p < .01, ***p < .001

With regard to significant main effects, examination of cell means indicated that LSP students (M = 42.93, SD = 22.25) scored significantly lower on the La Prueba Spanish reading achievement subtest than did FSP students (M = 51.74, SD = 22.36). With. regard to gender, boys (M = 47.82, SD = 22.91) scored significantly lower than girls (M = 53.05, SD = 21.90). The grade comparisons evidenced lower Spanish reading achievement with each increment in grade-level except the last. Specifically, the mean for grade one was 56.87 (SD = 22.15), grade two 53.82 (SD = 21.71), grade three 46.01 (SD = 22.99), grade cluster four 43.94 (SD = 20.17), and grade cluster five 47.47 (SD = 20.28). Tukey post hoc tests indicated that grade one Spanish reading scores were significantly higher ($p < .05$) than those for grade three, or grade clusters four and five. Likewise, grade two mean scores were significantly higher ($p < .05$) than scores for grade three or grade cluster four. Related to the aforementioned statistically significant interaction F-ratio (*SLAS* by grade) for Spanish reading achievement, a Bonferroni j post hoc analysis was performed. The results indicated that FSP students significantly ($p < .05$) outperformed their LSP counterparts at all grade levels except the first.

Collectively, results from this analysis indicated that girls scored higher than boys, FSP students scored higher than their LSP counterparts, and Spanish reading scores generally decreased with advancing grade level.

Analysis of La Prueba Mathematics Data. As shown in Table 3, significant main effects were noted for *SLAS* (MSe = 427.29, $F_{1, 657} = 5.59$. $p < .05$) and grade (MSe = 427.29, $F_{4, 657} = 8.93$, $p < .001$) but not for gender (MSe = 427.29, $F_{1, 657} = .81$, $p = .37$).

Related to significant main effects, examination of cell means showed that FSP program participants (M = 51.14, SD = 20.97) significantly outperformed the LSP participants (M = 48.21, SD = 21.97) on Spanish mathematics achievement. The grade results for Spanish mathematics achievement approached or exceeded La Prueba norm-level outcomes for all grades except third. Specific Spanish mathematics achievement means were as follows: grade one, 56.87 (SD = 20.95); grade two, 50.54 (SD = 22.95); grade three, 42.70 (SD = 19.57); grade cluster four, 50.36 (SD = 19.46); and grade cluster five, 51.17 (SD = 19.16). Tukey post hoc tests revealed that third-grade Spanish mathematics scores were

significantly lower ($p < .05$) than all other grade means. Conversely, grade ones mean score was significantly higher ($p < .05$) than grades two and three.

Table 3
Spanish Mathematics Achievement of Sampled Subjects Across Proficiency and Grade

Group	n	M	SD	F-ratio
Proficiency				559*
FSP	576	51.74	20.97	
LSP	100	48.21	21.97	
Grade				8.93**
1	158	56.87	20.95	
2	169	50.54	22.95	
3	121	42.70	19.57	
4[a]	107	50.36	19.46	
5[b]	121	51.17	19.16	

Note: Descriptive data for only significant main and interaction effects have been reported. FSP is fluent Spanish proficient and LSP is limited Spanish proficient subjects. [a]Grade 4 combined grades 4 and 5. [b]Grade 5 combined grades 6, 7 and 8.
$p < .05$, $^{**}p < .01$, $^{***}p < .001$

In summary, Spanish mathematics achievement results indicated that FSP subjects outperformed LSP subjects, and grade three students scored lower than the other four grades, while grade one students did better than those in grades two and three.

Analysis of La Prueba Social Studies Data. As shown in Table 4, significant Spanish social studies achievement main effects were attained for *SLAS* ($MSe = 406.63$, $F_{1\ 503} = 16.63$, $p < .001$), as well as for grade ($MSe = 406.63$, $F_{3,\ 503} = 7.60$, $p < .001$) but not for gender ($MSe = 406.63$, $F_{1\ 503} = .008$, $p = .93$).

Table 4
Spanish Social Studies Achievement of Sampled Subjects Across Proficiency and Grade

Group	n	M	SD	F-ratio
Proficiency				16.63***
FSP	462	54.06	20.15	
LSP	56	43.93	24.28	
Grade				7.60***
2	169	58.02	20.16	
3	121	52.66	20.91	
4[a]	107	47.97	18.87	
5[b]	121	50.64	22.11	

Note: Descriptive data for only significant main and interaction effects have been reported. FSP is fluent Spanish proficient and LSP is limited Spanish proficient subjects. [a]Grade 4 combined grades 4 and 5. [b]Grade 5 combined grades 6, 7 and 8. *p< .05, **p< .01, ***p< .001

Examination of cell means related to significant main effects revealed that LSP students (M = 43 93 SD = 24.28) scored lower than FSP students (M = 54.06, SD = 20.15). Related to grade comparisons, the following Spanish social studies achievement means were evident: grade two, 58.02 (SD = 20.16); grade three, 52.66 (SD = 20.91); grade cluster four, 47.97 (SD = 18.87); and grade cluster five, 50.64 (SD = 22.11). A Tukey post hoc analysis found that grade two Spanish social studies achievement scores were significantly higher ($p < .05$) than grade cluster four or grade cluster five.

To summarize, Spanish social studies achievement data indicated FSP students scored higher than LSP students, and second graders exceeded the performance of the two highest grade levels.

Analysis of La Prueba Science Data. As shown in Table 5, significant Spanish science achievement main effects were evident for *SLAS* (MSe = 393.08, $F_{1, 503} = 23.08$, $P < .001$) and grade (MSe = 393.08, $F_{3, 503} = 7.16$, $P < .001$) but not for gender (MSe = 393.08, $L_{1, 503} = .85$, $P = .36$). In addition, a two-way

interaction (MSe = 393.08, $F_{3, 503}$ =3.02, p < .05) was revealed for *SLAS* by grade.

Table 5
Spanish Science Achievement of Sampled Subjects Across Proficiency and Grade

Group	n	M	SD	F-ratio
Proficiency				23.08***
FSP	462	53.16	20.23	
LSP	56	40.68	20.99	
Grade				7.16***
2	169	56.34	22.28	
3	121	52.91	19.77	
4[a]	107	48.30	19.12	
5[b]	121	47.50	19.22	
Proficiency x Grade				3.02*
FSP Grade 2	144	58.34	21.88	
FSP Grade 3	110	55.50	18.33	
FSP Grade 4[a]	104	48.22	19.06	
FSP Grade 5[b]	104	48.47	18.89	
LSP Grade 2	25	44.84	21.45	
LSP Grade 3	11	27.00	14.74	
LSP Grade 4a	3	51.00	25.63	
LSP Grade 5b	17	41.59	20.74	

Note: Descriptive data for only significant main and interaction effects have been reported. FSP is fluent Spanish proficient and LSP is limited Spanish proficient subjects. [a]Grade 4 combined grades 4 and 5. [b]Grade 5 combined grades 6, 7 and 8.
*p< .05. **p< .01, ***p< .001

Regarding significant main effects, examination of cell means indicated that FSP students (M = 53.16, SD = 20.23) scored significantly higher than their LSP counterparts (M = 40.68, SD = 20.99) for Spanish science achievement. Similar to Spanish reading achievement, science grade comparisons indicated lower performance with each increment in grade level. Specifically, the

mean for grade two was 56.34 (SD = 22.28); grade three, 52.91 (SD = 19.77); grade cluster four, 48.30 (SD = 19.12); and grade cluster five, 47.50 (SD = 19.22). Tukey post hoc tests revealed that grade two Spanish science achievement outcomes were significantly higher ($P < .05$) than grade cluster four and grade cluster five. A statistically significant *SLAS* by grade interaction for Spanish science achievement was noted. The post hoc analysis using Bonferroni t revealed that LSP subjects at grades two, three, and grade cluster five scored significantly lower ($p < .05$) on the science achievement test than their FSP counterparts. There were no differences between FSP and LSP subjects for grade cluster four.

In summary, Spanish science achievement outcomes indicated that LSP students were outperformed by their FSP counterparts, and grade results decreased with each advance to the next grade. Interaction outcomes favored FSP over LSP students for all grades but grade cluster five.

Discussion

FSP/LEP Versus LSP/LEP Students. The first fundamental question addressed by this research involved a comparison of native language academic achievement between fluent Spanish proficient and limited Spanish proficient students in an MBE program. Significant main effects were noted for FSP/LEP and LSP/LEP subjects across all grades for Spanish reading, mathematics, social studies, and science achievement while significant interaction effects were evident for *SLAS* by grade for native language reading and science. Main effect results indicated that the more numerous FSP/LEP students significantly outperformed their less fluent counterparts for Spanish reading and mathematics (grades 1-8), as well as for Spanish social studies and science (grades 2-8). The highest mean performance for FSP/LEP students was for Spanish achievement in social studies, and their lowest levels were evident for Spanish mathematics performance, all at or above the Texas norms of the *La Prueba.* However, LSP/LEP subjects' Spanish academic performance across all grades appeared to fall below those same Texas norms for the four tests, ranging from a high for mathematics to a low for science. These results are particularly significant in the message they send to educators. Limited-language students constitute a large percentage of students in U.S. bilingual programs. Providing competent bilingual teachers is critical to affording these students the strong Spanish foundation

necessary to facilitate English acquisition at higher academic levels (Cummins, 1989). These findings corroborate earlier data reported by Medina (1991), wherein FSP/LEP subjects' Spanish mean academic performance in reading and mathematics was higher than outcome for LSP/LEP students in all instances. Lindholm and Aclan (1991) also reported similar outcomes for Spanish reading and mathematics, with high-proficient Spanish speaking bilinguals outperforming two less-proficient bilingual groups. Bilingual education theoreticians and researchers (Cummins, 1989; Hakuta, 1986; McLaughlin, 1985; Snow, 1992) have noted the importance of developing strong proficiency in the native language, as is evident in our FSP/LEP group, since this reciprocal language acquisition process may facilitate acquiring high levels of English. Perhaps the lower Spanish academic performance of LSP/LEP subjects suggests the need for additional programmatic support to overcome this lower threshold of L_1 and the possible future consequences of academic deficits in English (Cummins, 1989) for these language-limited students.

Significant interaction effects were noted for *SLAS* by grade for Spanish reading and science achievement. Post-hoc analysis revealed that LSP/LEP subjects performed as well as their more numerous FSP/LEP counterparts for first-grade Spanish reading; however, their performance was significantly lower across all other grades. Two interrelated factors may have contributed to this result. One was the programmatic emphasis on L_1 instruction in the district's MBE model. The first-grade time allotment for L_1 was 75%, and L_1 was to be given equal status to English. The second factor related to the greater similarity evident in the reading process for FSP/LEP and LSP/LEP students at the first-grade level. With each succeeding grade, the reading process becomes increasingly complex. This may account for LSP/LEP students doing better than FSP/LEP first-grade subjects in L_1 reading. Although bilingual theoreticians (Cummins, 1989; Hakuta, 1986; McLaughlin, 1985) support the premise that higher levels of native language proficiency should promote greater academic achievement in L_1, the nonsignificant Spanish reading result in first grade appears to contradict this theory. However, a careful examination of SLAS data suggests that LSP/LEP first graders may be more similar to their more numerous and fluent counterparts than those in higher grades. Three-fourths of these LSP/LEP students scored only one

SLAS level below the fluent classification. Furthermore, these less fluent first graders represented a greater percentage (28%) of their combined grade group (LSP/LEP + FSP/LEP) than any other grade group. Perhaps these two factors resulted in the first grade LSP/LEP and FSP/LEP students being more alike.

Post-hoc analysis found that LSP/LEP subjects had similar performance in fourth-grade cluster Spanish science to their FSP/LEP program counterparts, although their performance was significantly lower across each of the other three grade groups. For the fourth-grade cluster LSP/LEP subjects, this appeared to be an artifact of small cell size, which in this instance equaled three.

Gender Differences

The second question addressed by this study dealt with gender differences in Spanish achievement levels for students exposed to the MBE program. Developmental psychologists (Bjorklund & Frankel, 1989; Maccoby & Jacklin, 1974) have found fairly well-established gender differences in cognition related to verbal and mathematics ability. From preschool to early adolescence, verbal abilities for boys and girls are very similar; however, when there are differences, they favor girls and tend to occur in underprivileged (low SES) populations. By age 11, the verbal superiority of girls emerges and continues to increase through high school. Girls attain higher scores on receptive and productive high- and low-level language tasks (e.g., creative writing, reading comprehension of difficult content and analogies). In mathematics ability, boys and girls are, again, quite similar during the elementary grades; however, by age 11 or 12, boys outperform girls in this area (Bjorklund & Frankel, 1989; Maccoby & Jacklin, 1974).

Only two studies examined gender differences in reading and mathematics for Hispanic subjects. Within a transitional bilingual education (TBE) program, Medrano (1986) found no gender differences in reading or mathematics achievement for sixth-grade Mexican-Americans. In contrast, Fernández & Nielsen (1986), using the national "High School and Beyond' data base, reported that twelfth grade Hispanic bilingual males outperformed their female counterparts on English reading and vocabulary achievement tests and on mathematics achievement.

Consistent with the gender research in developmental psychology (Bjorklund & Frankel, 1989; Maccoby & Jacklin, 1974), in this examination of gender differences in Spanish

achievement levels for students exposed to the MBE program, girls scored significantly higher than boys in Spanish reading achievement. However, results for Spanish mathematics, social studies, and science achievement showed no significant differences.

Grade Differences

Regarding the third research question, which compares academic performance in Spanish across grade levels, significant main effects were found for our MBE program participants across all grades for Spanish reading, mathematics, social studies, and science achievement. In addition, significant interaction effects were reported for *SLAS* by grade for reading and science achievement in Spanish, the native language of these subjects. Mean scores for each of the four Spanish achievement subtests were compared to the Texas norms of *La Prueba* by grade.

Spanish Reading and Mathematics (Grades 1-8). Main effect results for Spanish reading indicated that grade 1 subjects significantly outperformed grade 3, and grade clusters 4 and 5, while second graders also scored significantly higher than grade 3 or grade cluster 4 for Spanish reading. These first graders were performing significantly above the Texas norms for *La Prueba*, while grade cluster 4 fell below those norms. These Spanish reading findings are similar to those reported in an earlier study (Medina, 1991), in which primary (grades 1-3), intermediate (grades 4-6), and junior high (grades 7-8) grade clusters performed at or above the Texas norms of the *La Prueba* for Spanish reading for five of the six instances examined. This earlier study (Medina, 1991) seems to support McLaughlin's (1985) theoretical premise regarding the importance of developing academic levels of proficiency in the native language in order to gain the benefit of its reciprocal effects on subsequent English acquisition. The Spanish reading results indicated by the present study for each grade except grade cluster four seem to suggest that these subjects may also benefit from this theoretical premise regarding L_2 language learning. Furthermore, for those grades at or above the Spanish reading Texas norms of *La Prueba*, there may also be an opportunity to use their L_1 reading proficiency to transfer those literacy skills to English (Wong Fillmore & Valadez, 1985). Nadeau & Miramontes (1988) found in their K-6 TBE study that students with higher reading achievement in L_1 scored higher in their English literacy

achievement and that L_1 literacy instruction served as a foundation and predictor of L_2 achievement. Regarding longitudinal empirical support for Spanish reading achievement in an MBE program, Saldate, Mishra, & Medina (1985) reported national norm Spanish reading achievement for Mexican American students by the end of third grade.

Significant interaction effects were reported for *SLAS* by grade for Spanish reading achievement. As previously discussed, post hoc tests revealed that FSP/LEP subjects performed as well as their less fluent counterparts for first grade L_1 reading, although their performance was significantly higher across all other grades and grade clusters.

Significant main effects for Spanish mathematics achievement found that grade 3 scored lower than all other grade groups, while first graders performed higher than second or third graders. Further, each grade or grade cluster except third scored at or above the Texas norms for *La Prueba* mathematics achievement in Spanish. In an earlier study, Medina (1991) found similar high levels of Spanish mathematics achievement for FSP/LEP and LSP/LEP subjects in a grades 1-8 MBE program. Secada (1991) noted in a recent study that first-grade Hispanics' bilingualism may be related to enhanced problem solving in mathematics, although he stated that by third grade, Hispanic underachievement in this subject area is well-documented. Other scholars (Willig. 1985; Wong Fillmore & Valadez, 1985) also support the use of L_1 to teach LEP students mathematics.

Spanish Social Studies and Science (Grades 2-8). Main effect outcomes for Spanish social studies achievement indicated that second graders significantly outperformed grade clusters 4 and 5, while also achieving significantly above the Texas norms for *La Prueba*. Mean scores for grade 3 and grade clusters 4, and 5 revealed performance at the appropriate grade level for the Texas norms of the social studies subtest. Although little research has been conducted regarding the instructional use of the native language for social studies education (Wong Fillmore & Valadez, 1985), these results would support such instruction for these low SES and LEP subjects in their MBE program. Only one other study was found that examined social studies achievement and native language instruction. Doebler & Mardis (1980-1981) compared the impact of bilingual and English-only instruction on the academic

achievement of second-grade Choctaw-speaking Native Americans and reported that bilingual instruction resulted in significantly higher social studies achievement.

Significant main effects for Spanish science achievement found that second-grade MBE subjects scored higher than grade clusters 4 and 5 (grades 4-8). Furthermore, these second graders scored significantly above the Texas norms of *La Prueba*, and all other grade groups scored at the norm level of the science subtest. Wong Fillmore & Valadez (1985) supported the use of L1 for science instruction, although they noted the paucity of research support for this recommendation. Doebler & Mardis (1980-1981), in the aforementioned study, also reported that bilingual instruction for these Native American second graders led to significantly higher science achievement. The results of the present study also support the use of native language instruction with LEP subjects in MBE-type programs.

Significant interaction effects were reported for SLAS by grade for Spanish science achievement. As previously discussed, post hoc tests found that LSP/LEP subjects had similar performance in Spanish science to their FSP/LEP program counterparts and significantly lower achievement across each of the other two grades and grade cluster. The fourth-grade cluster science outcome for LSP/LEP students appeared to be an artifact resulting from small cell size ($n = 3$).

Summary and Implications

In summary, the present study examined previously uninvestigated issues related to the possible mediational effects of native language proficiency and gender across selected grade levels on Spanish achievement in an MBE program. Although seemingly self-evident, we can now empirically support three ideas. First, FSP/LEP subjects academically outperform their LSP/LEP counterparts for Spanish reading, mathematics, social studies, and science achievement. Secondly, Spanish reading gender differences significantly favor girls, and no differences are evident for Spanish mathematics, social studies, and science achievement. Third, these low SES, Mexican-American, LEP students are consistently (16 of 18 times) performing in their native language at or significantly above the norms of the four subtests.

The findings of this present study provided empirical support for the possible mediational effects of native language proficiency and

gender across selected grade levels on Spanish achievement in an MBE program. The educational implications of this investigation closely parallel its three areas of scholarly inquiry. First, it seems evident that competent and highly fluent bilingual teachers are critically needed to provide the strong Spanish academic foundation exhibited by the FSP/LEP subjects and to develop additional native-language programmatic support for the LSP/LEP group to overcome their lower Spanish achievement. Second, practitioners should clearly note that while girls scored higher than boys in Spanish reading, both gender groups scored at the norm level of that subtest. Similar norm level performances for boys and girls were evident for Spanish mathematics, social studies, and science within the MBE program. Third, bilingual educators considering implementation of quality maintenance-type instructional programs (grades 1-8) for LEP, low- SES, Mexican-American students can utilize the empirical support provided by the present study for such a decision. This decision may even be generalized beyond Spanish achievement outcomes for reading and mathematics to include the vital content areas of social studies and science.

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