Hispanic High School Students' Mathematics Coursework, Grades and Attitudes: Follow- up of Immigrant English Learning and Fluent English Speaking Students in Two-Way Bilingual Programs

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Perspectives

Nationally, the academic performance of minority students is considerably below majority norms. According to the President's Advisory Commission on Educational Excellence for Hispanic Americans (1996), educational attainment for most Hispanics is in a "state of crisis": although the gap in some measures of educational attainment is narrowing, the "disparity in overall achievement between Hispanics and other Americans is intolerable" and Hispanic students drop out earlier and at unacceptably high rates. One of the risk factors implicated in the negative academic outcomes of Hispanic students is limited English proficiency at school entry.

Many researchers and business leaders have lamented the serious shortfall in the number of US students entering the fields of science and mathematics. This is especially true for underrepresented minority students such as Hispanics. As Clark (1999) points out, the lack of preparation in mathematics and science among Hispanics in the early elementary grades results in lower enrollment and success in secondary-level school programs, and ultimately in college and career choices. In both science and math courses taken and in student achievement, Hispanics remain underrepresented (NAEP, 2000; NSF, 1994), and the large achievement gaps have remained relatively unchanged since 1990 (NAEP, 2000). Further, somewhere around the middle school grades, many students, especially minority and female students, develop an aversion toward mathematics, resulting in enrollment in the fewest courses possible at the middle and high school levels. As the nation's economic base becomes increasingly technological and the demographic trends shift toward a higher representation of Hispanics in the US (25% of US population by 2050), participation and achievement in mathematics among Hispanic students become increasingly significant.

Two-way bilingual programs (a.k.a. dual language education programs) are designed to provide a high quality educational experience for language minority students and to promote higher levels of academic achievement (Lindholm-Leary, 2001; Lindholm-Leary & Borsato, 2001). In this program, both native English speakers and native Spanish speakers are participants and instruction is administered through both languages. There is a dearth of findings regarding the impact that two-way bilingual programs have on academic outcomes at the high school level, and particularly whether it improves the success of students who entered school with limited English proficiency.

Purpose and Research Questions

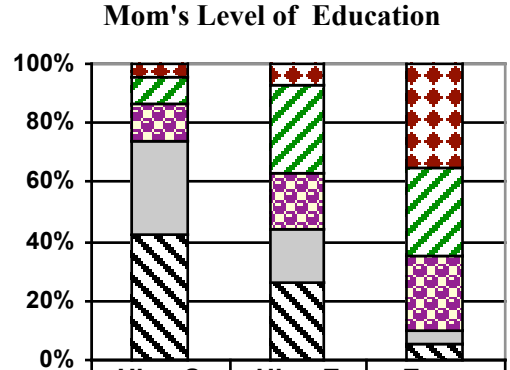
The purpose of this study is to examine Hispanic high school students, who had participated in a two-way program in elementary school, with respect to their performance in and attitudes toward mathematics. The research questions are focused on four major themes: 1) Students' current math courses, self-reported typical grades in math and science courses, and attitudes toward mathematics (*like math, good in math*); 2) College plans (e.g., attitudes toward attending college); 3) Study/work habits; 4) Previous achievement (on standardized tests in mathematics)

and attitudes toward mathematics in grades 6-8. Also, comparisons are made between: former Limited English Proficient Hispanic students (Hisp-S), former English-only Hispanic students (Hisp-E), and former English-only Euro American students (Euro) and between Hisp-S students who obtain A/B vs. B/C/D grades in math and science courses.

Methods

Participants. A total of 134 ninth-grade through twelfth-grade students participated in the study. All of these students had been enrolled in a two-way bilingual program since kindergarten or first grade at one of three public elementary schools in California. Students, who were divided equally between boys and girls and between 9th/10th graders and 11th/12th graders, were categorized into one of three groups on the basis of their ethnicity and their language background when they entered kindergarten--as a native English speaker or a native Spanish speaker/English learner. There were 89 Hispanic Spanish-speaking (Hisp-S) students, 27 Hispanic English-speaking (Hisp-E) students, and 18 Euro American English-speaking (Euro) students.

Students in the three groups differed significantly in their mothers' level of education (χ^2= 42.0,p<.001): higher levels of mom's education were represented among Euro students, followed by Hisp-E students, and the lowest levels of education represented among Hisp-S students (43% had moms with elementary level education and 32% with junior high-some high school).



	Hisp-S	Hisp-E	Euro
Coll Degree	5	7	35
Some Coll	9	30	30
HS Grad	12	19	25
Some HS	32	19	5
Elem	43	26	5

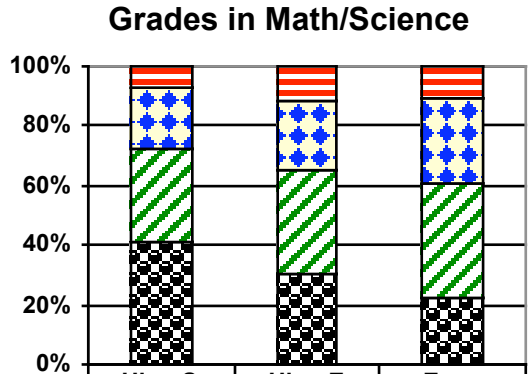
In order to assess differences in attitudes and learning contexts between Hisp-S students who perform at higher levels in math and science vs. Hisp-S students who do more poorly, the analysis that follows is based on comparisons between Hisp-S students who reported getting usually As or As/Bs (referred to as AB group; 24 students), and Hisp-S students who reported getting usually Cs/Ds or Bs/Cs/Ds (referred to as BCD group; 36 students). Chi-square tests indicated no significant differences between the two groups regarding mom's highest level of education (χ^2=2.41,n.s.) or participation in the free-lunch program during elementary school (χ^2=.41,n.s.).

Instrumentation. All students in the study completed a questionnaire that comprised questions concerning attitudes toward school; current schooling path and college ambitions; parent and teacher support. Most of these items were rated on a five-point Likert scale ranging from "strongly disagree" (1) to "strongly agree" (5). Only items relating to math and science performance and attitudes and general attitudes toward school were analyzed for this study. Other items requested demographic information (ethnicity, mom's educational background, participation in free lunch program, household composition).
Summary achievement data (standardized achievement test scores in math and science – in both Spanish and English) were also gathered for grades 6-8 for students from two of these schools.

Results and Discussion

Results indicated that:

1. Many students self report average grades in math/science. While Hispanic students tended to receive more Bs/Cs/Ds than Euro students, there was no statistically significant difference in the distribution of grades across the three ethnic/language groups: 28% of Hisp-S vs. 35% of Hisp-E (39% of Euro) received As or As/Bs; 31% of Hisp-S, 35% of Hisp-E (39% Euro) earned Bs and Cs; 41% of Hisp-S, 31% of Hisp-E (22% Euro) obtained Cs/Ds or Bs/Cs/Ds.



	Hisp-S	Hisp-E	Euro
Mostly A	7	12	11
A & B	21	23	28
B & C	31	35	39
B & C & D	41	31	22

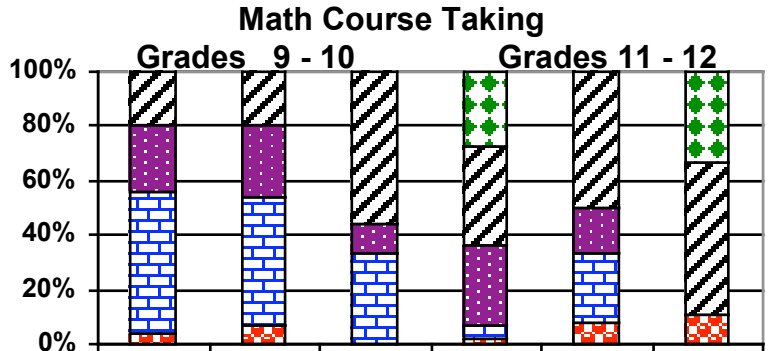
2. By grade 6, Hisp-SB students were scoring well above average in mathematics in Spanish (NCE=62) and in English (NCE=59). Further, while Hisp-SB students had begun second grade with significantly lower scores in math, by the time they were in sixth grade, there were no significant differences.

Mean NCE Scores (and Standard Deviations) for Math Achievement in English

ITEMS	Hisp-S	Hisp-E	Euro	Differences
Grade 2 (n= 25, 11, 9)	33.2 (23.5)	40.0 (23.6)	75.6 (16.9)	Euro>Hisp-S*** Euro>Hisp-E**
Grade 6 (n= 26, 14, 6)	59.0 (13.8) %ile = 67	60.2 (21.3) %ile = 68	69.8 (19.6) %ile = 82	NS

Note. Scores are averaged for all students who had 2nd grade scores or 6th grade scores.

3. In terms of the students' coursework in mathematics, at the 9th/10th grade level, only 6% of students were enrolled in basic math; 1/3 in algebra, and 30% of Hispanics, both S and E, in geometry. However, twice as many Euro (67%) compared to Hispanics (28-30%) were taking algebra. At the 11th/12th grade level, one student in each ethnic/language group was enrolled in basic math. Algebra and geometry accounted for 40% of Hisp-S and 56% of Hisp-E students. Another third (29-33%) from each group were taking algebra 2.



	Hisp-S	Hisp-E	Euro	Hisp-S	Hisp-E	Euro
Trig/Calc	0	0	0	27	0	33
Alg 2	20	20	56	37	50	56
Geom	24	27	11	29	17	0
Alg	52	47	33	5	25	0
Basic	4	7	0	2	8	11

The biggest difference was in trigonometry/calculus, where 26% of Hisp-S, no Hisp-E, and 57% of Euro students were enrolled. This difference in distribution across ethnic/language groups was statistically significant (χ^2=15.85,p<.05). In a comparison of the Hispanic students from two-way programs with Hispanic students not in two-way programs, there was a highly significant variation in math class enrollment across the two groups (χ^2=32.46,p<.001).

2. Most students (89%) indicated that they were not going to drop out of school. There was a significant difference between the three ethnic/language groups in the perception that the two-way program kept the student from dropping out of school. More Hispanic, both S (43%) and E (37%), than Euro (15%) students indicated agreement that the two-way program kept them from dropping out of school (χ^2=15.3,p<.05).

3. Majority of students of all backgrounds plan to attend a four-year college (63%); most students (80-94%) agree that they *want to go to college*, that *getting a good education is important*, and that *good grades are important*. The only ethnic/language difference was that Hispanics, both S and E (M=4.6), more strongly agree that they *want a college degree* than the Euro (M=4.1) students (F(2,135) =3.2,p<.05). Contrary to expectations, students in the BCD group were significantly more likely to agree with the statement *Good grades are important for getting into college* (M=4.7) than students in the AB group (M=4.1;t(58)=2.46,p<.05). Roughly the same proportion (58 %) of students in the AB and BCD groups indicated that they know the college entrance requirements.

Attitudes Toward College

Items	All Students Mean (SD)	Hisp-S Students Mean (SD)	Group Differences
It is very important to get good grades	4.4 (.72)	4.5 (.69)	None
Good grades are important for getting into college	4.5 (.89)	4.5 (.94)	None
Getting a good education is best way to have better life when I'm older	4.8 (1.6)	4.9 (1.8)	None
I want a college degree	4.5 (.85)	4.6 (.81)	*Hisp>Euro

Note. Range from 1 (disagree strongly) to 5 (agree strongly) * p < .05

4. In assessing the perceived academic competence attitudes of students in both grade groups, overall, students had a positive perception of their academic competence. Students in the AB group scored significantly higher in their agreement to *I am good at my school work* (M=4.1) than students in the BCD group (M=3.6;t(58)=2.26,p<.05). No statistically significant differences were found between the two groups in their responses to *I am a good student, I can do almost any problem if I keep working at it*, *I don't care whether I understand something or not as long as I get the right answer*, *When doing my schoolwork I guess a lot so that I can finish quickly*, *I take time to figure out my work, I go back over schoolwork I don't understand,* and *I spend some time thinking about how to do my work before I start it*. However, students in the AB group were significantly more likely to answer that they *usually get their homework done on time* (M=4.1) than students in the BCD group (M=3.3), t(58)=3.62, p<.01).

5. Over half of all students say they like mathematics and school (M=3.5, scale is 1-5), though the score lies between neutral and agreement). There were no group differences. In grades 6-8, students were largely in agreement (1=strongly disagree to 4=strongly agree) that they

like math (M=3.0) and do well in math (M=2.9). While liking math was not correlated with math achievement in grades 6-8, their self perception of being good in math (M=3.0) was moderately correlated with their math achievement scores in both English (r=.30,p<.05) and Spanish (r=.25,p<.05). By high school, Hisp-S students who get better grades in math and science differ only slightly in their responses to the statement *I like mathematics* from those who get poorer grades. No statistically significant differences were found, although AB students tended to agree with this statement more than BCD students.

School Attitude Items

Items	All Students Mean (SD)	Hisp-S Students Mean (SD)	Group Differences
I am a good student	4.0 (.74)	4.0 (.75)	None
I am good at my school work	3.9 (.76)	3.9 (.76)	None
I like challenging problems	3.4 (.88)	3.6 (.73)	None
Take time to figure out school work	3.7 (.85)	3.7 (.83)	None
Go back over work I don't understand	3.6 (.85)	3.6 (.89)	None
Can do almost any problem if keep working at it	3.9 (.86)	3.9 (.86)	None
Do homework on time	3.7 (.95)	3.7 (.92)	None
I like math	3.5 (1.1)	3.4 (1.2)	None

Note. Range from 1 (disagree strongly) to 5 (agree strongly)

7. Most students agree that *learning two languages helped them do better in school*, *gave them a better education, helped them to think better, made them smarter; challenged them to do better and gave them a sense of accomplishment; gave them the confidence to do better in school* (significantly more Hisp-S than Hisp-E or Euro). When asked how they *compare in their schoolwork with their peers who were not in two-way bilingual*, only a handful of students felt they were behind compared to students in non-two-way; over one third felt they were ahead of their peers, particularly Hispanic students. The remaining students felt their academic performance was comparable to that of their peers.

Conclusions

Results suggest that students who participated in the two-way bilingual program intend not to drop out of school, have the desire to attend college, understand the importance of getting good grades, have positive academic attitudes, and perceive that they received a better education in the two-way program and that they are doing at least as well as their non-two-way peers. These results are all important with respect to schooling in general. While Hisp-S students scored average (in Spanish) to slightly below average (in English) on standardized tests of mathematics in middle school, they continue to receive about average grades in mathematics (Bs/Cs). Their attitudes toward math (*I like math*), which were more positive in middle school are still fairly positive, though not strongly so, and clearly not as negative as the aversive attitudes discussed in the literature. These students, particularly the most at-risk previous EL students, appear to be more successful than the average Hispanic students depicted in the literature, despite their very low socio-economic level and parental education level. Furthermore, while not enough of these students are receiving the A/B grades to get them into the better universities, there are some EL students that are, and most Hispanic students are taking high level college preparation math courses and getting mostly average grades (B/C) in those courses. These results suggest that the two-way bilingual program may provide the academic preparation and schooling attitudes, even in mathematics, that enable these students to be more successful than the average at-risk Hispanic and low socio-economic students described in the literature.