Perspectives from Latin America: International Lessons for U.S. English Language Learners

Warren Roane
Humble Independent School District, Texas
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Does language ability impact math achievement? The U.S. National Center for Educational Statistics, part of the U.S. Department of Education, examined math scores and English language ability over ten years ago. When considering achievement scores on the National Education Longitudinal Study of 1988, "[t]he positive coefficient on the percent of LEP students in the regressions that used control variables indicates that limited English proficiency may not be a substantial handicap on math tests. Indeed, international studies consistently rank U.S. school children among the lowest in math performance. Perhaps in schools with higher proportions of LEP students, the students are able to draw more from their prior mathematics knowledge" (Taylor, 1997). This statement gives rise to four questions about students with limited English proficiency (LEP), or to use a more current term, those who are ELLs (English language learners). First, does ELL status impact math scores? Second, does immigrant status favorably contribute to math achievement? Third, what math achievement is possible in other countries where there is multilingualism or high immigrant populations? Fourth and most specifically, how can international exams help us address the issue of Latin American ELLs in Texas, who make up almost 15 percent of students (Texas Education Agency, 2008)?

Despite Taylor's assertion, it would seem that ELL status is significant, as it is negatively related to math scores in the U.S. The National Assessment of Educational Progress examination allows the exclusion of students because of language ability (National Assessment of Educational Progress, 2008). Immigrant status also seems to affect math achievement, as National Council of Teacher of Mathematics (NCTM) Standards-based curricula were designed to close achievement gaps between U.S. students and high achieving international students, as well as gaps between U.S. student groups. However, a recent study of middle school students shows that there are no simplistic solutions to erase these gaps in U.S. student groups. Though most students performed at or above expectations, certain sub-groups performed worse than expected, including low SES and ELL populations. In terms of ethnicity, Black and Hispanic students scored "significantly lower" than white students (Post and Harwell et al., 2008, p. 206). However, the second question, about the impact of immigrant status on math scores, indicates background knowledge would be lower than native students, at least based on country of origin for immigrants to Texas, as these come primarily from Latin America. The Program for International Student Assessment (PISA) 2006 data indicate that Latin American students score lower overall in mathematics (Uruguay, 427; Chile, 411; Mexico, 406; Argentina, 381; Colombia, 370; Brazil, 370) than students from the United States (474), which in turn was lower than the international average (OECD, 2008). This pattern was also true for the PISA 2003 study, which focused in detail on mathematics ability.

To answer the fourth question, the results from the PISA 2003 and the TIMSS 2003 will be used to examine mathematics programs from Latin America for initiatives that can help mathematics for English Language Learner programs in the United States, with particular attention to Texas. The PISA 2003 focused on math literacy and was age-specific. Participant countries from Latin America were Mexico, Uruguay, and Brazil. The TIMSS (Trends in International Mathematics and Science Study) had a curricular emphasis, and was grade-specific (Lange, 2007). It was administered in Argentina and Chile from Latin America. For the PISA, at 70 percent, the U.S. had double the percentage of students above Level 1 proficiency compared to Latin America, while Latin America had about the same percentage of students who were at Level 1 proficiency (defined as basic, all information given, routine problems) as the United States. There may be a variety of reasons for the discrepancy of rates of higher proficiency. Latin American countries had difficulty giving opportunities for students to achieve high levels of mathematics (Proyecto Regional de Indicadores Educativos Cumbre de las Américas, 2005). Also, the PISA 2000 showed that only 20 percent of 15 year olds in Latin America were at a high or acceptable level of reading compared to 67 percent of U.S. students. In addition, the U.S. had a much higher school completion rate for 15 year olds and a lower rich-poor achievement gap compared to Latin America (Administración Nacional de Educación Pública Programa Internacional de Evaluación de Estudiantes, 2005).

The TIMSS model was somewhat different, focusing on three types of curriculum: the intended curriculum (national context), the implemented curriculum (school and classroom context), and the attained curriculum (student outcomes). It covered categories of number, algebra, measurement, geometry, reasoning, and solving routine problems (Martin & Mullis, 2006). This study indicated that in Latin America achievement was related to social class. For example, in Chile more affluent communities had higher levels of math proficiency (Ramirez, 2006). Several other factors were related to math achievement, such as the number of students in classrooms, which also was a predictor of science success (Talisayon, Balbin, and De Guzman, 2006). There were class size effects for students whose teachers had low salaries—classes were larger and resulted in fewer successful students in areas where teachers were paid less (Wossmann, 2006). In general, countries with high scores on the TIMSS had specific math content at every grade level with hierarchical ordering rather than spiraling (Prawat & Schmidt, 2006).

For English Language Learners in Texas, 91 percent are Spanish speakers (Texas Education Agency, 2008). Of these, most come from Mexico, El Salvador, Honduras, Guatemala, and Colombia (US Census Bureau, 2007). The first international comparative study of academic achievement in math and language in 1997 found that Latin American countries are similar in that they all have low rates of completion, low achievement levels in math, and have gaps in achievement due to SES (Proyecto Regional de Indicadores Educativos Cumbre de las Américas, 2005).

The international comparisons imply three conclusions: economic inequity hurts math achievement, class size should decrease, and teacher pay should increase. However, these factors hold true to some degree for all U.S. students as well. If so, why do additional gaps exist for U.S. English Language Learners? Three possibilities will be examined: poverty, ethnicity, and language. Poverty has a significant effect on curricular instruction; race and ethnicity may also play a major role (NCTM, 2001). However, teachers are "reluctant to reflect on race and student performance in mathematics" (Tate & Rousseau, 2007, p. 1226). In general, there is a lack of research on how race interacts with math (Diversity in Mathematics Education Center for Learning and Teaching, 2007). There are definite gaps in math achievement (based on race and ethnicity) in the U.S. as measured by the NAEP, the National Assessment of Educational Progress (NCTM, 2000). Language barriers also seem to be a major factor, but difficult to quantify. The correlations between language proficiency and mathematics achievement are "significant", but "complex" (Secada, 1992). Often, low ability in English is a barrier to math (MacGregor & Price, 1999). In addition, failure to consider specific needs of ELLs has been a mistake in attempts to reform math (Tate & Rousseau, 2007).

A more significant barrier to math success than poverty, ethnicity, or language is the interaction of ethnicity and language ability. Nationally, while 50 percent of Hispanic students were "below basic" in 8th grade math as assessed by NAEP, 71 percent of ELLs were in this category, a discrepancy of 21 percent (Fry, 2007, p.6). In Texas, this gap increased to 37 percent. Among U.S. Hispanics, students from homes where only Spanish is spoken scored lower than students from English-only homes (Secada, 1992). In Texas the passing rate on the Texas Assessment of Knowledge and Skills (TAKS) for ELLs was half that of Hispanics in general (Texas Education Agency, 2007). Yet immigrant populations and English Language Learners should not by themselves account for gaps in U.S. math scores. The cases of Canada and Singapore address the third question in this study, which is immigrant populations do not necessarily have to negatively affect math achievement. "Singapore accommodates its heterogeneous population by practicing principles of multiracialism and meritocracy. It practices true bilingualism in grades 1 through 3 when, although English is the primary language of instruction, children from each major ethnic group also study their home languages" (American Institutes of Research, 2005, p.8). Canada has a similar ELL immigrant population percentage as the U.S. (Lipka, Siegel, and Vukovic, 2005), yet has scored among the highest of countries on the PISA 2006. It also scored highest on instructional equity among high achieving countries (Council on Ministers of Education, 2008).

If other countries have avoided achievement gaps, what can be done to address them in the U.S.? One way would be to develop oral language skills and reading skills in native language first since language skills (speaking, reading, and writing) transfer from one to the next (Snow, Burns, and Griffin, 1998). If true bilingualism is not possible, what are ways to reduce these gaps for English Language Learners? Some of the major difficulties ELLs encounter are differences in vocabulary, the U.S. measurement system, algorithms, and classroom structure. There is a big difference between ordinary language (Basic Interpersonal Communication Skills) and academic language (Cognitive Academic Language Proficiency) acquisition for ELLs (Cummins, 1979). Though sometimes math employs "relatively restricted" vocabulary, terms used imprecisely in ordinary language are taken to be precise in math (Fillmore & Valadez, 1986). However, language concerns should not bring math learning to a halt. Teachers can help ELLs develop concepts before all language is mastered, as mathematics has three forms--informal vernacular, technical subject-specific, and symbols (Thomas, 1997). Differentiated instruction, additional instruction time, support for each student, and high expectations are needed for ELL success in math (Leiva, 2006). Finally, teachers should be aware that algorithms vary by culture and that alternative algorithms should be valued (Carraher, Carraher & Scliemann, 1985; D'Ambrosio, 1985).

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