Catching up in Math?
The Case of Newly-Arrived Cambodian Students in a Texas Intermediate School

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ABSTRACT

This article reports the findings of a case study of two newly arrived 5th grade students from Cambodia attending a Texas intermediate school. The students could not speak any English at the time of their arrival, yet federal and state policy required that they take and pass the 5th Grade Math TAKS test at the end of the school year. This article describes efforts of the school to help the students catch up to their grade-level peers in math, but calls into question the appropriateness of the policy to test newcomer ELLs in English on high-stakes tests, and the reasonability of the expectations that these students should pass the test. Detailed analyses of the students' prior education in Cambodia, the type of work they were capable of completing in school, and the content and linguistic demands of the TAKS test items, reveal that these policies and expectations are not reasonable for newly arrived ELLs.

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Newcomer English language learning (ELL) students—immigrant students who arrive in the United States and begin school with little or no proficiency in English—face a number of challenges, as do the schools and educators charged with meeting their linguistic, cultural, and academic needs. Bilingual education programs have been shown to be very effective in helping ELL students learn English and academic content before they are transitioned into mainstream classrooms (August & Hakuta, 1997; Cheung & Slavin, 2005; Rolstad, Mahoney, & Glass, 2005; Slavin & Cheung, 2003; Thomas & Collier, 2002). Unfortunately, quality bilingual programs are in short supply, and few bilingual programs are available for non-Spanish-speaking ELL students. While Spanish-speaking ELLs make up more than 80% of the over 5,000,000 ELL students nationwide (National Clearinghouse for English Language Acquisition, 2003), and 94% of the ELLs in Texas, the remaining quarter of a million ELLs across the country are a diverse group with students from hundreds of different language minority groups. In Texas alone, there are over 37,000 non-Spanish-speaking ELLs—more than the total ELL student population in 30 of the 50 States, and more than the total ELL student populations of Delaware, Kentucky, Maine, Mississippi, New Hampshire, South Carolina, South Dakota, Utah, and West Virginia combined[i]. One large school district in San Antonio recently reported it has ELL students who speak 118 different languages or dialects (Lacoste-Caputo, 2006).

In the absence of bilingual education programs, it becomes incumbent on schools to offer the best possible ESL and sheltered English content-area instruction possible. Nonetheless, as these students are required to learn academic content in English at the same time they are learning the language, catching up to their English-fluent peers at their grade level is a major challenge. Cummins (2003) describes this challenge as follows:

> Research has repeatedly shown that ESL students usually require *at least* 5 years of exposure to academic English to catch up to native-speaker norms. In addition to internalizing increasingly complex academic language, *ESL students must catch up to a moving target*. Every year, native-speakers are making large gains in their reading and writing abilities and in their knowledge of vocabulary. In order to catch up to grade norms within 6 years, ESL students must make 15 months' gain in every 10-month school year. (p. 3; Emphasis in original)

Adding to this challenge are the mandates of the federal No Child Left Behind (NCLB) Act, and Texas' own school accountability and high-stakes testing programs. Under state and federal law, ELL students must take the state's high-stakes test—the Texas Assessment of Knowledge and Sills (TAKS)—and schools are held accountable for the results (Valenzuela, 2004). The TAKS test is only offered in English and Spanish, thus non-Spanish-speaking ELL students have no choice but to take the TAKS in English. NCLB allows newly arrived ELLs to be excluded from the language arts portion of the test during their first year of enrollment, but students still must take the Math portion of the TAKS, regardless of how long they have been in the United States. The federal law calls for ELLs to be provided with "reasonable accommodations" which enable ELLs to be tested in a "valid and reliable manner" (Wright, 2005a, 2005b). The Texas Education Agency has developed extensive guidelines for Linguistically Accommodated Testing (LAT) for the TAKS Math subtest—guidelines that are designed to meet the requirements of the federal law to make the English language test more accessible to ELLs, particularly those who are unable to take the exam in their native language (Texas Education Agency, 2005). Despite the state's efforts, little research is available (and that which exists is inconclusive) in terms of how ELLs can actually be accommodated on large-scale high-stakes tests while maintaining the validity and reliability of the testing instrument (Abedi, 2004; Hollenbeck, 2002; Liu, Anderson, Swierzbin, & Thurlow, 1999; Rivera, 2003; Rivera & Stansfield, 1998; Wright, 2005a). Moreover, as will be argued in this article, the attempts at accommodation do not address the deeper issues of the appropriateness of requiring newly arrived ELLs to be tested in English, or the reasonability of the expectations as established by the state's standards and high-stakes test (Abedi, 2004; Valenzuela, 2004; Wright, 2005b).

The research question addressed in this study is, how reasonable is the expectation that newly arrived non-Spanish-speaking ELLs can catch up to their peers in grade-level math instruction sufficient to pass the TAKS Math test in English? To answer this question, this article reports the findings of a case study of two newly arrived 5th grade students from Cambodia attending an intermediate school in the greater San Antonio, Texas area. The two students, Nitha and Bora, are sisters who arrived in the United States in October 2004. Neither could speak any English at the time of their arrival, and by the time they entered school, it was already two months into the school year. In addition to helping Nitha and Bora learn English, the school placed major emphasis on math instruction, given the fact that they would be required to take the TAKS Math test, and given the fact that (technically) they would have to pass it in order to be promoted to 6th grade.[ii] Thus, the school put forth considerable effort to help these newly arrived students catch up in math to their English-fluent grade-level peers.

The methodology utilized in this study is described below, followed by descriptions of the participants and the research site. Next, the general issue of math instruction for ELLs is described, noting the particular areas of difficulty this content area can pose. The study then compares and contrasts the level of math instruction Nitha and Bora received in Cambodia, the level of math instruction they received once they arrived in Texas, and the level of math required to pass the TAKS test. In addition, there is a comparison of the linguistic complexity of the work the students were able to successfully complete in school, versus the linguistic complexity of actual TAKS Math test items. The conclusion discusses the implications of the findings of this study for other newly-arrived ELLs in Texas and throughout the United States.

Methods

This case study utilizes participant observation, interviews with teachers and support personnel, and the collection and analysis of school-based documents (e.g., policy documents, memos, notes, lesson plans, curricular materials, progress reports, assessments, etc.) and samples of work completed by the two students. The first author (Wright), who is proficient in Khmer (Cambodian), volunteered at the school an hour each week from November 2004 to May 2005 to provide primary language support and math tutoring for Nitha and Bora. In addition to the tutoring sessions, observations were conducted in Nitha and Bora's regular and ESL classrooms, in their tutoring sessions with a (non-Khmer-speaking) paraprofessional, and in the school's computer lab (where the students used a math software program). Digital audio recordings were made and field notes were taken during the tutoring session and in the observations described above. Formal interviews were conducted with the classroom teacher, ESL teacher, and the paraprofessional, and these interviews were digitally audio-recorded and fully transcribed. Detailed field notes were also kept of informal conversations with these individuals and other school personnel. Fieldnotes, transcripts, and documents were imported into and organized using QSR Nvivo, a qualitative data analysis software program.

Content-level analyses were conducted of the students' math instruction in their classroom, tutoring sessions, and the computer lab, and of TAKS math test items from the released 2004 5th grade Math TAKS test. To determine the grade-level equivalency of the students' math work in class, samples of the math work collected throughout the school year were matched with state's math content standards outlined in the Texas Essential Knowledge and Skills (TEKS), for Kindergarten through Grade 5. These standards were also matched to the released 5th grade Math TAKS (if Math TAKS is a proper term, then "math" should be capitalized when used this way; otherwise, not capitalized) test items.

In addition to the content-level analysis, student work and test items were also analyzed from a linguistic framework to determine the relative level of linguistic difficulty of the student work and test items. A lexical analysis was completed by compiling a list of all words appearing in the students' math worksheets, and this was compared to a list of all words appearing in the Math TAKS test. Words were classified according to their frequency of use in English and in terms of the number of math-specific vocabulary words. Analysis was aided by the use of an on-line vocabulary profiler tool (see below). Sentence-level analyses were also conducted to determine the syntactic complexity of sentences appearing in the student worksheets versus the TAKS test items.

Analyses of our qualitative research data were guided by the work of Erickson (1986) and Miles and Huberman (1994). To maintain the confidentiality of the participants, all names of students, teachers and staff, and the school are pseudonyms.

Participant and Site Description

Nitha and Bora are sisters who arrived in Texas in the middle of October 2004. In Cambodia, they lived in a poor village in the Takeo Province, far from their provincial capital or any major cities. They live with their aunt and uncle in a spacious two-story home—a far cry from the one-room thatched hut with no electricity or running water where they used to live. The girls had attended school in their village since Kindergarten; Nitha, who is older, had completed 6th grade, and Bora had completed the 4th grade.[iii] Despite the poor condition of Cambodian schools (Um, 1999), particularly in the rural areas, both girls had strong Khmer (Cambodian) literacy skills, and could do basic arithmetic. While both reported they were among the top students in their class, the curriculum they received in their school in Cambodia was far below that of equivalent grade-levels in American schools (see below). Neither had studied English before coming to the United States, and could not speak a single word of English upon their arrival. Despite differences in personality, both showed a tremendous amount of courage as they faced the challenges of adjusting to a new country, a new school, as well as a strange language, customs, and food.

Rodgers Intermediate School, Nitha and Bora's neighborhood school, is in a medium-sized Texas school district of 13 schools serving 7,636 students in grades PreK-12. The district is located in a suburb, on the outskirts of San Antonio, in a rapidly growing area. Rodgers provides instruction to 590 students in grades 5 and 6. Over half of the students are white (58%), 29% are Hispanic , 10% are African American, and only 2% are Asian/Pacific Islanders. The school is located in a middle-class neighborhood, and only 31% of students participate in the free/reduced lunch program (well below the state average of 53%). English language learners represent less than 1% of the schools' enrollment. In the 2004-2005 school year, Rodgers was rated as "Academically Acceptable" by the Texas Education Agency (District and School information retrieved from www.greatschools.net).

Math Instruction for ELLs

A common misconception is that of all the academic content areas, Math instruction poses the least amount of difficulty for English language learners because it relies less on language and more on numbers. Indeed, the federal policy appears to be based on this assumption, as newly arrived ELLs may be excluded from their state's reading tests, but not the math tests, during their first year of enrollment. However, research has shown that math instruction in general, and high-stakes math tests in particular, have a high language demand that poses significant difficulties for ELLs and which prevents students from demonstrating their mathematical knowledge and skills (Abedi & Lord, 2001; Brown, 2005; Buchanan & Hellman, 1997; Dale & Cuevas, 1992).

Brown (2005) describes math as having "a language all its own," and describes math as a "third language" that ELLs must learn (p. 340). Dale & Cuevas (1992) describe this unique "language of mathematics" as follows:

> The language register for mathematics is composed of meanings appropriate to the communication of mathematical ideas together with the terms or vocabulary used in expressing these ideas and the structures or sentences in which these terms appear. Like other registers or styles of English, the mathematics register includes unique vocabulary, syntax (sentence structure), semantic properties (truth conditions), and discourse (text features). (p. 332)

The vocabulary of math includes words that are specific to math (e.g., divisor, denominator, quotient), everyday words that have specific meanings in math contexts (e.g., table, column, equal), and complex phrases (e.g., least common multiple, negative exponent) (Dale & Cuevas, 1992). The syntax of math can be confusing, as there may not be a one-to-one correspondence between the words and symbols they represent, and the order of the words may not necessarily correlate with the order in which the numbers and math symbols are written in a numeric equation or sentence (e.g., "the square of the sum of x and y" = $(x+y)^2$). In addition, as Dale and Cuevas (1992) have observed, mathematical texts are conceptually packed, have high density, require left-to-right as well as up-and-down eye movement, must be read more slowly than natural language texts, often require multiple readings, and use numerous symbolic devices such as charts and graphs (p. 338). Furthermore, math tests typically rely on word problems that may contain complex syntax that must be understood in order to answer the problem correctly.

Another challenge is that ELLs who received math instruction in their home countries may have learned different algorithms for problem solving and may use mathematical symbols differently than the way they are used in the United States (Brown, 2005; Jarrett, 1999). For example, in Cambodia (and many other countries) the decimal is used in the same way the comma is used in the United States to separate place value, and the comma is used as the decimal is used here (e.g., the number 5,234,232.56 would be written as 5.234.232,56 in Cambodia).

Abedi and Lord (2001) have documented how the language factor in tests of mathematics—which often rely heavily on word problems full of unfamiliar vocabulary and difficult syntax—causes great difficulty for ELL students. Cummins (2003) notes:

> ESL students often make good progress in acquiring basic computational skills in the early grades, however, they typically experience greater difficulty in carrying out word problems, and this difficulty increases in the latter grade of elementary school as the word problems become more linguistically and conceptually complex. (p. 2)

In order to successfully answer word problems, students need to know how to read well. Indeed, there is a high correlation between reading ability in English and performance on (English-language) mathematics tests (Brown, 2005). Evidence for the fact that math is indeed heavy-laden with language demands can found in test scores for ELLs in Texas and Arizona, where many ELLs actually score lower on their Math test than they do on reading and writing tests (Wright & Pu, 2005).

Schooling and Math Instruction in Cambodia

In addition to language challenges, another major obstacle for newly arrived students in catching up with their grade-level English-proficient peers has to do with the notion of opportunity to learn. As noted by Brown (2005), "math learning must be accrued," meaning simpler concepts must be mastered (e.g., addition, subtraction) before more difficult and complex concepts can be learned (multiplication, division, fractions, ratios, etc.) (p. 340). Brown observes that "as ELL students proceed to higher grades, they face increasingly greater challenges in keeping up or catching up with their counterparts" (p. 340).

Oftentimes, newcomer ELLs from developing countries come from schools that are very poor and do not offer a curriculum that is equivalent to the level and demand of similar grade levels in the United States.[iv] This is certainly true in the case of Cambodia. By 1979, during the Cambodian Genocide under the Khmer Rouge, nearly all schools in the country had been shut down, and the majority of teachers had been executed, died of starvation, or fled as refugees (Becker, 1986; Chandler, 1993; Kiernan, 1996; Wright, 2004). Reestablishing schooling in Cambodia in the early 1980s was a major challenge, and despite tremendous progress over the past 16 years, many problems remain today in terms of providing even the most basic education to all of Cambodia's school-aged children (Clayton, 2002; Needham, 1996). According to recent Cambodian government reports (Ministry of Education, 2004; Planning Department, 2006), many schools lack water, restroom facilities, electricity, or even walls or roofs. In addition to poor facilities, average class size for primary schools is between 40 and 60 students. The amount of instructional time is considerably less than the United States, as most students only attend half-day (morning or afternoon). Many students, especially females in the rural areas, drop out of school as early as the primary grades. In the Takeo Province where Nitha and Bora attended school, 69% of the primary school teachers have less than a high school education.

The Cambodian government is still struggling to provide each student with a textbook, each school with curricular guidelines for basic subject areas, and each teacher with adequate training (Ministry of Education, 2004; Planning Department, 2006). The government is just now beginning work on defining minimal standards of student achievement for each grade level and content area. Current math textbooks in Cambodia are small flimsy paperback books with poor binding, and printed on low quality paper in black-and-white ink. There is only one math textbook available nationally per grade level, and math textbooks tend to focus on computational problem solving rather than word/story problems. The textbooks Nitha and Bora used for math instruction in their Cambodian classrooms stand in stark contrast to the large, thick, colorful math textbooks approved for use in Texas public schools. More importantly, the content of the Texas math textbooks provide much greater depth and breadth than Nitha and Bora were afforded the opportunity to learn as students in Cambodia.

In summary, while Nitha and Bora were fortunate to attend school in their home country, their level of education was not on par with those of their grade-level peers educated in the United States. While both were excellent students in their village in Cambodia, Nitha and Bora simply did not have the opportunity to learn the level of mathematical content expected of students in the same grade levels in Texas. Thus, when they entered the fifth grade at Rodgers Intermediate school, even without the language barrier, they were already academically far behind their classmates.

Math Instruction at Rodgers Intermediate School

When Nitha and Bora first arrived at Rodgers Intermediate school (two months into the school year), the teachers and staff were quite apprehensive as even the most basic communication with the girls was difficult. Their classroom teacher, Mrs. Moore, described a hectic first week of just trying to help them adjust to the classroom, helping them get lunch in the school cafeteria (food which they were afraid to eat), and conveying to them safety rules such as not running out into street, looking both ways before crossing streets, and using the crosswalks. While the school had an excellent and experienced pull-out ESL teacher, Mrs. Moore was frustrated as she knew Nitha and Bora needed much more support than she was able to provide in her classroom. Through persistence with her administrators and the help of some of her colleagues, arrangements were made for the Nitha and Bora to receive daily assistance for one or more hours a day from a paraprofessional, about an hour a week of Khmer primary language support and tutoring from an volunteer from the local university (the first author), and additional support through the school's computer lab.

Mrs. Moore decided that, in addition to English language development, math instruction would be a major focus because, as she described, "the math TAKS is the first thing they start to hold all kids responsible for." Each week she would carefully plan and gather the necessary materials for use in the tutoring sessions. Rather than attempt to use the designated 5th grade math curriculum—which she found was too far beyond the girls' level—Mrs. Moore pulled together hands-on manipulatives and worksheets from supplemental workbooks designed for lower grade levels. She saved for later the more challenging "higher-order" concepts and worksheets, which were closer to 5th grade level for the primary language tutoring sessions, as these concepts proved too difficult for her and others to teach in English.

Computer Lab

The school's computer lab utilized a software program for self-paced reading and math instruction produced by Compass Learning.[v] The use of this software allowed students to work and progress at their own level. The program's levels corresponded with grade levels (e.g., K, 1, 2, 3 etc.). The program utilizes graphics and sounds, with child-friendly illustrations and animations to help students explore math concepts. The program then gives students guided practice, followed by a check-up with multiple-choice or other problem-solving-type questions. If students do not get the questions right, they must repeat the lesson until all questions are answered correctly. For students who have difficulty reading the on-screen text, they can choose to have the computer read it aloud to them (in English).

Arrangements were made for Nitha and Bora to have two extra sessions a week in the computer lab in addition to their regularly scheduled time with their class. Due to Nitha and Bora's lack of English language proficiency, and the inability of the school to determine their level of math knowledge, the computer lab teacher decided to start them out at the Kindergarten level. Less than seven months later, both girls had completed the Kindergarten and Grade 1 levels, and were just beginning the Grade 2 level. According to the Compass Learning manual, the Kindergarten level "addresses major concepts, such as place/value numeration, whole numbers, measurement, and beginning geometry." The Grade 1 level covered these same areas but at a slightly higher level. When they girls began the Grade 2 level, they were working on lessons titled "Ones, Tens, and Hundreds" and "Count by 10s and 100s." Despite tremendous progress—completing over two grades levels of math in less than 120 school days—the fact that they were far behind their fifth-grade peers was evidence by the content of lessons from the Grade 5 level that their fellow classmates were working on. While Nita and Bora were counting pictures of boats and tents by 10s and 100s, their classmates were completing lessons with titles such as "Introducing Percentage," "Averaging with Decimals," "Calculating Multidigit Sums," "Arranging Data," and "Measuring Quadrilaterals."

The mathematic concepts covered in the K- 2nd grade levels were similar to ones Nitha and Bora had already learned in Cambodia, however the girls said the work in the computer lab was hard for them, mainly due to the language barrier. While the program provided read-aloud support, they simply did not have enough vocabulary to understand the words. Nitha even quit wearing the headphones, complaining that they hurt her ears. Even when the paraprofessional or computer lab teacher provided assistance, they had difficulty understanding. Observations of their work in the computer lab revealed that they got through the program by trial-and-error. They did their best to try and figure out the concepts through the illustrations and examples. Oftentimes they would have to repeat a lesson anywhere from two to five times. Sometimes they would fly through the "exploring" and "guided practice" portions, just to get to the check-up questions so they could get the right answers (by choosing different options than they did previously) and move on.

Student Math Work in Class, with a Paraprofessional, and with the Khmer Primary Language Support Tutor

Despite the low level of the work completed in the computer lab, Nitha and Bora completed higher-level work in class (with help from the teacher) with their paraprofessional, and in particular with the Khmer primary language support tutor. An analysis of samples of student math work completed over the school year shows that the two made substantial progress from worksheets covering concepts at the Kindergarten level, to those covering 5th grade-level concepts by the end of the school year. Nearly all of the worksheets utilized story problems, rather than straight-forward computational tasks and drills. This was a conscious decision on the part of Mrs. Moore, after she determined the girls had basic computational skills but needed to learn how to read and solve story problems, as this is what they would encounter on the TAKS test.

The concepts and skills covered progressed from interpreting simple picture graphs to single-digit addition and subtraction, two- and three-digit addition and subtraction with regrouping, modeling and naming fractions, adding and subtracting decimals to the hundredths place, adding and subtracting fractions with like denominators, two- and three-digit multiplication and division, and solving multi-step/multi-operational problems. These worksheets did not come from the school's adopted math curriculum, *Saxon Math* (Hake & Saxon, 1997), but rather from supplemental workbooks (such as those published by School Zone Publishing Company, www.schoolzone.com) commonly available at teacher supply stores. Table 1 provides examples of the simple and straightforward word problems Nitha and Bora completed on these worksheets and the concepts they covered.

Table 1. Examples of the Types of Math Problems Completed by Nitha and Bora

2-Digit Addition with Regrouping
Adam found 91 small twigs and 29 larger twigs for the campfire. How many twigs did he find all together? (Addition Story Problems, p. 2)
2-Digit Subtraction with Regrouping
Jennifer sold 72 candy bars. Patti sold 56 candy bars. How many more candy bars did Jennifer sell? (Subtraction Story Problems, p. 4)
1-Digit by 2-Digit Multiplication
Daniel has 3 cases to hold his toy trucks. Each case holds 18 trucks. How many trucks can Daniel store in his cases? (More Multiplication Story Problems, p. 15)
2-Digit by 1-Digit Division (no remainder)
Jason swam 81 laps over a 9-day period. If he swam the same distance every day, how many laps

did he swim each day? (More Division Story Problems, p. 18)

Money Addition Problems with Decimals (and regrouping)
Jaric saw a bottle of shampoo that cost $1.72. He also saw conditioner that cost $1.18. If he purchased both items, what would the sum be? (Addition and Subtraction Problems, p. 7).

Adding Fractions with Common Denominators
Luis used 1/4 cup of paste in one tray and 2/4 cup in the other. How much paste did he use altogether? (More Fractions in Story Problems, p. 24)

Note: All examples are from math workbooks (grades 1-5) published by School Zone Publishing Company.

Two major foci of the tutoring sessions, by both the paraprofessional and the Khmer primary language support tutor, were helping Nitha and Bora locate the numbers needed to solve the problems and locating the key words that signaled which operation to use (e.g., sum, total, in all = Addition; difference, are left, how many more = subtraction, etc.). Despite the fact that these simple word problems assumed a great deal of vocabulary and American cultural knowledge, and the efforts of the Khmer tutor to translate and explain each word problem, Nitha and Bora soon discovered they could solve these word problems without the need to read or understand them. Once they understood the concept, they were simply able to pull out the numbers and figure out the operation from the clue words to get the right answer. Oftentimes it was easy to figure out the operation because each worksheet focused on only one or at the most two operations, with easily identifiable clue words.

The classwork provides evidence that Nitha and Bora were somewhat successful in catching up to their grade level peers in Math. However, most of the worksheets were completed with assistance. In addition, most, if not all, of their work completed covered only the "Number, Operation, and Quantitative Reasoning" strand of the TEKS Math Standards (see Table 2), focusing mainly on word problems leading to simple computations. Even the worksheets covering Grade 5 content standards were much simpler than the math work being completed by their classmates.

The 5th Grade Math TEKS describes the focus of Grade 5 math as follows:

> Within a well-balanced mathematics curriculum, the primary focal points at Grade 5 are comparing and contrasting lengths, area, and volume of geometric shapes and solids; representing and interpreting data in graphs, charts, and tables; and applying whole number operations in a variety of contexts. (Texas Essential Knowledge and Skills, §111.17. Mathematics, Grade 5, (a)(1))

The student work samples reveal that the math work completed by Nitha and Bora did not even begin to address most of the areas outlined in the Grade 5 Math TEKS. Indeed, none of the students' work samples were aligned with the following major sections in the Grade 5 Math TEKS: Patterns, Relationships, and Algebraic Thinking; Geometry and Spatial Reasoning; Measurement; Probability and Statistics; or Underlying Processes and Mathematical Tools.

While some of these concepts were covered in their work in the computer lab, these concepts were covered only at the Kindergarten and First Grade levels (see Table 1).

Grade 5 math textbooks approved for adoption by the Texas Education Agency, including the one used in Nitha and Bora's classroom (*Saxon Math*), cover a broad range of math concepts and are generally aligned to the TEKS.[vi] Thus, while Nitha and Bora were solving simple word problems covering basic number sense and operations (typically at the K-3 level), their classroom peers were completing work from grade-level textbooks covering more difficult math concepts.

Fifth-Grade Math TAKS Test

While the actual TAKS test which Nitha and Bora were required to take in the Spring of 2005 is not yet available, the Grade 5 Math TAKS test from Spring 2004 (Texas Education Agency, 2004) has been released by the Texas Education Agency and serves as the basis of analysis in this section. While the version taken by Nitha and Bora obviously contained different test items, the 2004 released test nonetheless is considered by the TEA to be equivalent enough to warrant year-to-year comparisons, and thus is arguably representative of the depth, breadth, and complexity of the types of problems Nitha and Bora encountered when taking the TAKS in 2005.

The 44 math questions on the TAKS test differ substantially from the type of math work completed by Nitha and Bora. Only six of the problems were similar to the worksheet problems they had had been practicing; that is, word problems that required straight computation to obtain a single number answer. However, even these types of familiar problems were more difficult on the TAKS test, as most required logical reasoning, multiple steps, and more than one operation. In many problems, extra information and numbers are given which are not required to solve the problem (see linguistic analysis section below for an example).

Many of the TAKS items did not ask for a number resulting from a straight calculation. Rather, students were required to pick answers that demonstrated their mathematical reasoning. For example, Question 37 asked:

> A track team ran 4 miles in 36 minutes. Which shows how to find the number of minutes it would take the track team to run 20 miles?
>
> A 36 ÷ 4 = 19, so 9 x 20 = 180 minutes
> B 4 x 9 = 36, so 9 x 36 = 324 minutes
> C 36 ÷ 4 = 9, so 4 x 36 = 144 minutes
> D 4 x 5 = 20, so 5 x 20 = 100 minutes

Another difficulty of the TAKS items is the fact that nearly half (20) of the problems required the use and interpretation of graphs, tables, charts, and illustrations to solve problems—tasks with which Nitha and Bora had little practice. Most importantly, however, is the fact that 5th Grade TAKS Math test contained a breadth and depth of grade-level concepts and skills that went well beyond what Nitha and Bora were able to learn by the time they were required to take the TAKS test. Table 2 reveals the extent to which Nitha and Bora's math work was well below grade level and did not cover the broad range of knowledge and skills needed for the TAKS.

Table 2. Nitha and Bora's Math Work vs. Grade 5 TAKS Math Test

Nitha and Bora's Math Work *(Computer Lab and Worksheets)*	**5th Grade TAKS Math Test**
Number, Operation, and Quantitative Reasoning	
<u>*Worksheets*</u> • Single-digit addition and subtraction (*1st grade*) • Two- and three-digit addition and subtraction with regrouping (*2nd – 3rd grade*) • Modeling and naming fractions (*2nd grade*) • Adding and subtracting decimals to the hundredths place (*4th grade*) • Adding and subtracting fractions with common denominators (*5th grade*) • Two- and three-digit multiplication and division (*4th – 5th grade*) • Solving multi-step/multi-operational problems (*5th grade*) <u>*Computer Lab*</u> • Whole Numbers concepts 0-19 (*Kindergarten*) • Add and subtract whole numbers to 10 (*Kindergarten*) • Money value (*Kindergarten*) • Add and subtract 1- and 2-digit numbers (*1st grade*) • Place value and numeration to the hundreds place (*2nd grade*) • Identify and write simple fractions (*1st grade*) • Counting money and making change (*1st grade*)	• Addition and Subtraction, up to 5-digits (including decimals and money) • Multiplication, up to 1-digit x two-digit • Division, up to 3-digits divided by 1-digit. • Prime factors, common factors of a set of whole numbers • Multi-step problem solving requiring logical reasoning to identify the correct number sentence needed to solve the problem • Comparing (e.g., <, >, =) fractions without common denominators • Adding fractions (single digits) with common denominators • Reduce factions with up to 3 digits to single digits • Comparing decimals to the thousandths place • Converting decimals to fractions • Interpreting and using data in charts, graphs, and tables to solve problems • Estimation and rounding
Geometry and Spatial Reasoning	
<u>*Computer Lab*</u> • Plane figures (*Kindergarten*) • Plane and solid shapes (*1st grade*)	• Describe shapes and solids in terms of vertices, edges, and faces • Parallel lines • Calculating perimeter • Calculating volume • Congruency and symmetry • Identify coordinates of points of a line on a graph • Describe the transformation that generates one figure from the other when given two congruent figures (reflection, translation, rotation)
Measurement	
<u>*Computer Lab*</u> • Comparing length and height (*Kindergarten*) • Telling time (*Kindergarten – 1st grade*) • Using a calendar (*1st grade*)	• Relationships between units of time using fractions (e.g., 1 second is 1/60 of one minute) • Determining the amount of elapsed time

• Measure length in inches (*1st grade*) • Measure weight using pounds (*1st grade*) • Use liters and kilograms (*1st grade*) • Convert cups, pints, quarts (*1st grade*)	• Convert pounds to ounces • Convert inches to feet/feet to inches • Convert liters to milliliters • Describe numerical relationships between units of measure within the same measurement system such as an inch is one-twelfth of a foot
Probability and Statistics	
Worksheets • Interpreting simple picture graphs (*Kindergarten – 1st grade*) *Computer Lab* • Pictographs and bar graphs (*Kindergarten*) • Tallying and Pictographs (*1st grade)*	• List all possible outcomes of a probability experiment • Determine the median from data provided in a table
Patterns, Relationships, and Algebraic Thinking	
None	• Identify the patterns in number sets (make generalizations from patterns or sets of examples) • Identifying missing information in a word problem needed to solve the problem

Linguistic Complexity of Student Work vs. TAKS Test Items

On top of the wide discrepancy between the level of the questions in the TAKS test and the students' math work, the linguistic complexity of the TAKS test items also posed great difficulties for Nitha and Bora. A linguistic analysis of the math worksheets completed by the students, and the math items on the released Grade 5 Math TAKS test reveals major differences in complexity on both the lexical and syntactic levels.

Lexical Level

Table 3 provides an overview of the number of words on Nitha and Bora's math worksheets in comparison with the TAKS test. In terms of the number of words, the worksheets may appear to be more challenging as they required more vocabulary. However, this larger number of words is really a function of the large number of worksheets completed over seven months of school versus a single test which is typically completed within one to two hours. A much different picture emerges, with a more sophisticated linguistic analysis.

Table 3. Number of Words on Student Math Worksheets and 5th Grade Math TAKS

	Student Math Worksheets	**TAKS Math Test**
Questions (pages)	122 (24 pages)	44 (18 Pages)
Words (including repetitions)	2,685	1,429
Unique words	603	491

The word lists for the student math worksheets and the 5th Grade Math TAKS test were imported into the Web Vocabulary Profiler, a freely available on-line research tool developed by the University of Quebec at Montreal (http://www.lextutor.ca/vp/eng/). The Vocabulary Profiler divides the words of texts into various categories based on the frequency of usage in English at large and into the following categories: first thousand words (broken down further into First 500 function and content words, and Second 500 content words), second thousand words, academic words (550 words that are frequent in academic texts across subjects), and off-list words (i.e., those not on the above lists). Table 5 reports the results of these analyses.[vii] With a focus on these categories, the number of unique words is surprisingly nearly even, with the student math worksheets containing only 24 more words than the TAKS Math test. However, the number of academic and math specific words on the TAKS Math Test is more than double those on the student math worksheets. Indeed, the mathematical lexical density (math words divided by unique words) is 47% for the TAKS Math test items, as compared to only 26% for the student math worksheets.

Table 5. Lexical Demands of Student Math Worksheets vs. 5th Grade Math TAKS

	Student Math Worksheets		**TAKS Math Test**	
Word Category	*Unique Words*	*Math Words*	*Unique Words*	*Math Words*
First 1,000 (content) words	231	60	179	70
Second 1,000 words	73	6	62	22
Academic words	9	5	26	13
Off-list math words	14	14	36	36
Total	***327***	***85***	***303***	***141***

As revealed in Table 5, the lexical demands in general, and demand for specific math vocabulary knowledge in particular, on the Math TAKS test are much higher than those Nitha and Bora encountered on their worksheets. For example, many math-specific academic words, such as *digit*, *rectangular*, *congruent*, *parallel*, *transformation*, and *diagram*, just to name a few, do not occur a single time in the student math worksheets. On the TAKS, however, these are often the key words necessary to understand to solve the problems.

Another lexical issue is related to the clue words, which served as a crutch for Nitha and Bora when completing their worksheets. As described above, the girls often did not need to read the problems on their worksheets in order to solve the problems; they simply pulled the numbers and looked for the clue words signaling the appropriate operation. Unfortunately, these familiar clue words did not appear anywhere in the TAKS items. An exception was in Question 40, where the clue word "had left" appears. However, the clue word here is of little help, as Question 40 is a multi-step logical reasoning problem requiring students to identify missing information needed to solve the problem. Table 6 provides a contrast of the "clue words" in the student worksheet versus the TAKS test item.

Table 6. Clue Words in Student Worksheet and TAKS Test Item

Student Worksheets **TAKS Item (Question 40)**

Matt picked 8 apples. He ate 2 of them. How many does he ***have left***? (with picture support)	Juan bought 4 packets of notebook paper for school last year. Each packet contained 500 sheets of paper. He used about 20 sheets of paper each week. What information is needed to find the approximate number of sheets of paper Juan ***had left*** after the school year was over? F. The number of hours Juan did homework every day. G. The number of classes Juan had. H. The number of students in Juan's grade. J. The number of weeks in the school year.

Another linguistic challenge is the fact that many TAKS questions give more information than is needed. Students cannot determine which information is needed or not needed unless they can read and fully understand the question. Take Question 21 as an example:

> Bart's drama club put on a play. There were 843 people in the audience. Each ticket to the play cost $8. The audience was seated in 3 sections. If each section had the same number of people in it, how many people were in each section?

Here, the price of each ticket is not needed to solve the problem, but students struggling to read in English may be tricked into using the number 8 in their calculations. Yet another lexical difficulty is the fact that 17 of the 44 TAKS questions required students to select an answer that partially or totally contained words rather than only numbers. Occasionally, students would have to convert a word in the problem to a number in order to get the correct answer. For example, two problems required students to know that a *dozen* equals 12, while another problem required students to convert the number 200,000,000,000 to word form (two hundred billion). Finally, as discussed above, there are many examples in the TAKS test of lexical items that have common meanings that may be known to ELLs, but that have different meanings within the math register: face, table, feet, sum (some), product, fair, volume, figure, point, even, odd, translation, place (as in place value), and ruler.

Syntactic Level

In addition to the difficulties on the lexical level, more challenges (in terms of the linguistic complexity) reside in the syntactic structures of the test items. There are all together 246 sentences in the questions in the student worksheets, 225 (91.5%) of which bear basic subject-verb-object (SVO) sentence structures. In contrast, for the TAKS test questions, there is a total of 118 sentences of which only 88 (74.6%) have the basic SVO sentence structures. Figure 1 provides the results of a detailed analysis of the specific syntactic features of the student worksheets versus the TAKS Math test items.

As can be seen in Figure 1, the sentence structures in the TAKS questions are much more complicated than those in the student worksheets, as the former outnumbers the latter in almost every syntactic feature except "conditional clause" and seven out of twelve (looks awkward to spell out seven and not 12 in the same sentence) syntactic features examined never occur in the student worksheets. Although there are more conditional clauses in the student worksheets than in the TAKS test, three out of the seven conditional clauses in the TAKS items occur in multiple-clause sentences.

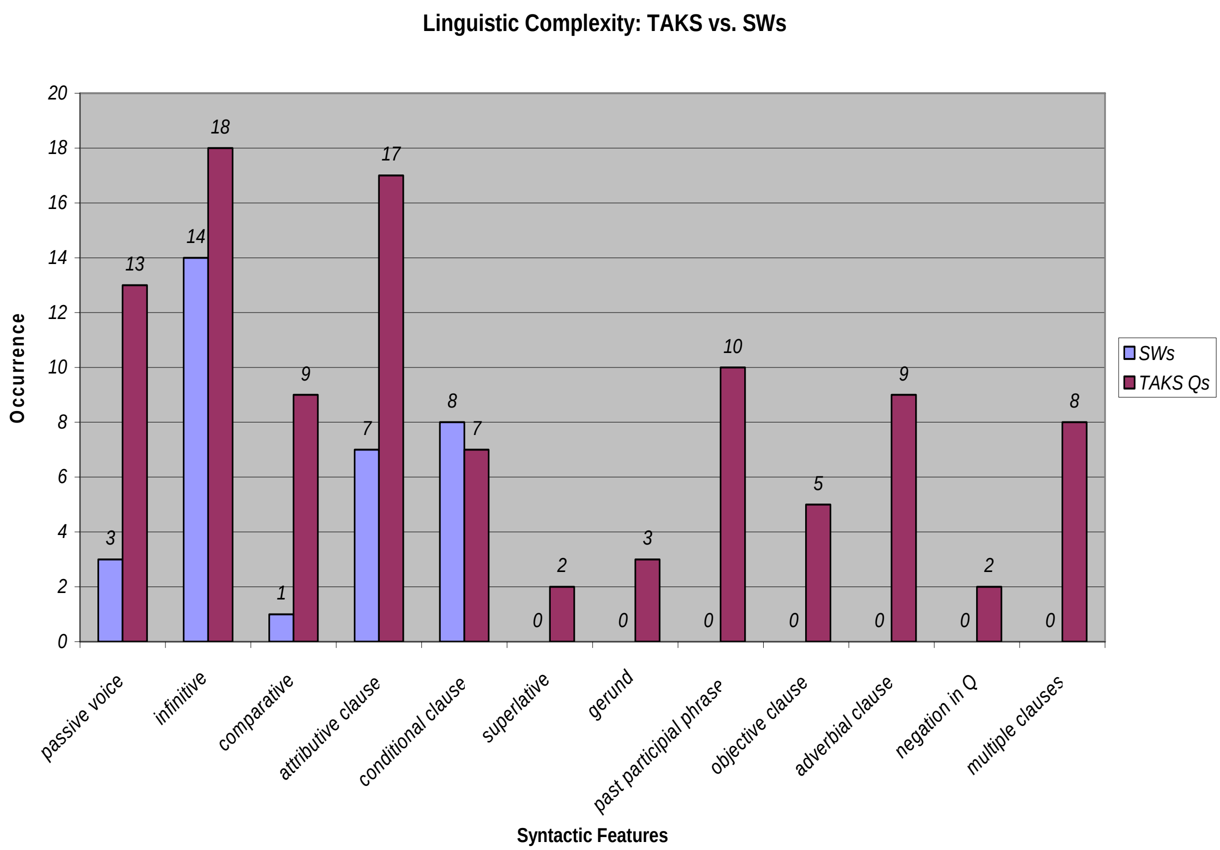

Figure 1. Syntatic Complexity of Student Worksheets (SWs) vs. TAKS Questions
Note: Numbers represent raw number of occurrences

Multiple clauses occur eight times in seven questions in the TAKS test but never in the student worksheets. Seven out of the seventeen attributive clauses, two out of the five objective clauses, and four out of the nine adverbial clauses in the TAKS test occur in multiple-clause sentences. For example, consider the following multiple-clause sentence in Question 22: "What is the least number of boxes he can buy so that each fifth-grader gets at least 1 ice-cream bar?" In order to answer this question correctly, and ELL student would need an understanding of every linguistic feature in this sentence, including the phrase "at least," and the superlative, attributive, and adverbial clauses.

Another syntactic challenge for ELLs is negation in questions. The 5th Grade TAKS Math test contained two questions with this syntactic feature:

> Question 4: "Which of the following combinations of supplies does she NOT have enough money to buy?" (emphasis in original)
>
> Question 8: "Which is NOT a way to find how much money Leanne spends on lunches each week?" (emphasis in original)

Negations in the questions of multi-step problems with difficult lexical items and complicated sentence structures (without the benefit of familiar clue words) are certainly beyond the reasonable range of capability for most newcomer ELLs such as Nitha and Bora.

Students' Performance on the TAKS Math Test

Nitha and Bora were required to take the TAKS Math Test in April of 2005 after having only been in a U.S. school for a little over six months. As mentioned above, as newly arrived ELLs, Nitha and Bora were entitled to some form of linguistically accommodated testing. The school had hoped that the Khmer primary language support tutor could administer the test and provide translation, or at the very least, provide a bilingual glossary with translations of math terms. However, queries to the district and the Texas Education Agency indicated that these accommodations would not be allowed as the tutor was not an employee of the school district, and as the classroom teacher would not be able to verify that the bilingual glossary contained only translations, and did not contain any explanations. In short, Nitha and Bora took the exact same Math TAKS test as their English-proficient peers, and with no linguistic accommodations.

When Nitha and Bora's scores came back, Mrs. Moore expressed little surprise at their low scores—Nitha answered six out the 44 questions correctly, while Bora answered only seven correctly. What was surprising, however, is that Nitha scored lower than Bora. Nitha, who was older and had more education in Cambodia, was clearly more skilled in math than her sister, as demonstrated by her work in class. Indeed, she was typically the first one to understand difficult math concepts, and then she would teach them to her sister. Mrs. Moore even observed that Nitha was trying harder on the TAKS test than Bora. Mrs. Moore suspects that Bora was simply making random guesses. At one point during the test, Bora bubbled-in five answer circles in a row on her answer sheet, and then shouted out enthusiastically, "BINGO!"

Conclusions and Implications

Nitha and Bora, two sisters from a poor village in Cambodia, arrived in Texas and began school in 5th grade (two months into the school year) with literally no English proficiency whatsoever. While both were top students in their village school, the poor condition of education in Cambodia meant they had little access to a well-defined curriculum, adequate textbooks, or knowledgeable teachers. The level of math instruction they received in Cambodia was far below that provided to their Texas peers. Despite their lack of English and opportunity to learn grade-level math content, Nitha and Bora were nonetheless required, by state and federal policies, to take and pass the Grade 5 Math TAKS test. For various reasons, they did not receive the linguistic accommodations to which they were entitled.

Given the fact that their school could not reasonably be expected to offer a Cambodian bilingual program, Nitha and Bora faced the challenge of learning grade level content at the same time they were learning English. The teachers and staff at Rodgers Intermediate school went to great lengths to help Nitha and Bora learn English and catch up to their grade-level peers, particularly in math. They provided differentiated instruction, ESL instruction with an experienced teacher, substantial daily one-on-one instruction with a paraprofessional, extra assistance through the computer lab, and even weekly primary language support tutoring sessions where Nitha and Bora could learn new math concepts in Khmer.

As a result of these efforts, Nitha and Bora made tremendous progress in a short period of time. By the end of the school year, both could hold simple conversations with school staff and peers in English, both learned to read in English up to about the 2nd grade level,[viii] and both made over two-years of growth in math. Unfortunately, No Child Left Behind and Texas's testing and accountability program do not recognize or reward this kind of progress. In the end, the school's efforts were simply not enough to help Nitha and Bora catch up in math to their grade-level peers sufficiently to pass the 5th Grade Math TAKS test.

The case of Nitha and Bora calls into question the appropriateness of federal and state policies in regard to mandates that newly arrived ELLs be included in statewide high-stakes testing programs, and the reasonableness of expectations that these students perform at the same level as their English-proficient peers. These expectations are further complicated when newly arrived ELLs speak languages for which there are no bilingual programs or tests written in their native languages. As shown above, academically speaking, Nitha and Bora's math knowledge and skills upon arrival were already far below their peers because the poor education system in Cambodia did not provide them the opportunity to learn the breadth and depth of content expected in Texas as outlined in the Math TEKS. Even without the language barrier, catching up to their peers in math would have been a major challenge.

The language barrier, however, makes a clear case that catching up to their peers and passing the Math TAKS test would have been nearly impossible for the girls. Teachers and staff struggled the first few months just to communicate with Nitha and Bora. The students' vocabulary was not sufficient to learn grade-level math content, and the simplified math worksheets and work in the computer lab—which proved challenging enough to Nitha and Bora—did not cover the full range of math concepts covered on the TAKS, nor did these efforts expose them to level of math-specific vocabulary covered on the TAKS. The linguistic analysis of the TAKS Math test items themselves reveal a wide range of lexical and syntactic complexities that a newly arrived ELL student could not reasonably be expected to comprehend.

The case of Nitha and Bora raises a number of implications that apply (using the word "equally" makes a very broad and sweeping statement for which no evidence is provided—the idea is clear without this word) to newly arrived ELLs throughout Texas and the United States in terms of including such students in state high-stakes testing and accountability programs:

- There cannot be a one-size-fits-all policy regarding the testing of ELL students.
- Policies need to take into account students' educational backgrounds from their home countries and their prior opportunity to learn content covered by high-stakes tests.
- Policies need to take into account the students' levels of English language proficiency.
- Policies need to recognize the fact that many newly-arrived ELLs speak a language for which there are no bilingual programs or tests.
- Policies need to acknowledge that "linguistically accommodated testing" rarely happens in practice, and that current research on valid and reliable test accommodations for ELLs is lacking.
- State and federal accountability systems need mechanisms to ascertain the entry-level abilities of newly-arrived ELLs (and all other students) and track their progress over time.

- State and federal accountability systems need to recognize and reward schools and ELL students who make significant improvements over time, rather than punishing them if they fail to attain pre-determined passing test-scores designed for English-proficient students.

Some current political leaders contend that those who argue against the full inclusion of ELLs in high-stakes testing and accountability programs exhibit the “soft bigotry of low expectations.” However, based on the findings of this study, we argue that requiring newly-arrived ELL students like Nitha and Bora to take and pass the TAKS exhibits a *hard discrimination of unrealistic expectations*. Indeed, in Texas and many other states, unrealistic expectations are used to deny ELL (and other) students grade-level promotions and high school diplomas. Unless policies and programs are made more reasonable for newly arrived ELLs, many of them will likely be left behind.

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REFERENCES

Abedi, J. (2004). The No Child Left Behind Act and English language learners: Assessment and accountability issues. *Educational Researcher, 33*(1), 4-14.

Abedi, J., & Lord, C. (2001). The language factor in mathematics tests. *Applied Measurement in Education, 14*(3), 219-234.

August, D., & Hakuta, K. (1997). *Improving schooling for language-minority children: A research agenda*. Washington, DC: National Academy Press.

Becker, E. (1986). *When the war was over: Cambodia's revolution and the voices of its people*. New York: Simon & Schuster.

Brown, C. L. (2005). Equity of literacy-based math performance assessments for English language learners. *Bilingual Research Journal, 29*(2), 337-364.

Buchanan, K., & Hellman, M. (1997). *Reforming mathematics instruction for ESL literacy students*. Washington, DC: Center for Applied Linguistics.

Chandler, D. P. (1993). *A history of Cambodia*. Chiang Mai, Thailand: Silkworm Books.

Cheung, A., & Slavin, R. E. (2005). Effective reading programs for English language learners and other language-minority students. *Bilingual Research Journal, 29*(2), 241-268.

Clayton, T. (2002). Language choice in a nation under transition: The struggle between English and French in Cambodia. *Language Policy, 1*(1), 3-25.

Cummins, J. (2003). *Supporting ESL students in learning the language of mathematics*. Glenview, IL: Pearson Education, Inc.

Dale, T. C., & Cuevas, G. J. (1992). Integrating mathematics and language learning. In P. A. Richard-Amato & M. A. Snow (Eds.), *The multicultural classroom: Readings for content-area teachers* (pp. 330-348). New York: Longman.

Hake, S., & Saxon, J. (1997). *Math 65: An incremental development* (2nd ed.). Norman, OK: Saxon Publishers, Inc.

Hollenbeck, K. (2002). Determining when test alterations are valid accommodations or modifications for large-scale assessments. In G. Tindal & T. H. Haladyna (Eds.), *Large-scale assessment programs for all students: Validity, technical adequacy, and implementation* (pp. 395-425). Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.

Jarrett, D. (1999). *Teaching mathematics and science to English-language learners*. Portland, OR: Northwest Regional Educational Laboratory.

Kiernan, B. (1996). *The Pol Pot regime: Race, power, and genocide in Cambodia under the Khmer Rouge, 1975-79.* New Haven, CT: Yale University Press.

Lacoste-Caputo, J. (2006, 1/20-1/21). Influx of foreign students taxing Northside District; Children speaking 31 languages and 87 dialects are being accommodated. *San Antonio Express News*.

Liu, K., Anderson, M. E., Swierzbin, B., & Thurlow, M. (1999). *Bilingual accommodations for limited English proficient students on statewide reading tests: Phase 1 (Minnesota Report 20)*. Minneapolis: University of Minnesota, National Center on Educational Outcomes. Retrieved January 1, 2003, http://education.umn.edu/NCEO/OnlinePubs/MnReport20.html.

Ministry of Education. (2004). *Cambodian education strategic plan 2004-2008*. Phnom Penh, Cambodia: Royal Government of Cambodia.

National Clearinghouse for English Language Acquisition. (2003, June). The growing number of limited English proficient students 1992/93 - 2002/03. Retrieved May 15, 2005, from

http://www.ncela.gwu.edu/policy/states/reports/statedata/2002LEP/Growing_LEP0203.pdf
Needham, S. A. (1996). *Literacy, learning and language ideology: Intracommunity variation in Khmer literacy instruction.* Unpublished Doctoral Dissertation, University of California, Los Angeles, Los Angeles.
Planning Department. (2006). *Education statistics and indicators (School year 01/02)*. Phnom Penh, Cambodia: Ministry of Education, Youth, and Sports.
Rivera, C. (2003). *Preliminary findings: State assessment policies for English language learners 2000-2001.* Paper presented at the Language Minority Research Institute, San Diego, CA.
Rivera, C., & Stansfield, C. W. (1998). Leveling the playing field for English language learners: Increasing participation in state and local assessments through accommodations. In R. Brandt (Ed.), *Assessing student learning: new rules, new realities* (pp. 65-92). Arlington, VA: Educational Research Service.
Rolstad, K., Mahoney, K., & Glass, G. (2005). The big picture: A meta-analysis of program effectiveness research on English language learners. *Educational Policy, 19*(4), 572-594.
Slavin, R. E., & Cheung, A. (2003). *Effective reading programs for English language learners: A best-evidence synthesis* (No. Report No. 66). Baltimore: Center for Research on the Education of Students Placed at Risk, John Hopkins University.
Texas Education Agency. (2004). Texas Assessment of Knowledge and Skills - Grade 5 (Released Spring 2004 test). Retrieved February 14, 2005, from http://www.tea.state.tx.us/student.assessment/resources/release/taks/2004/gr5taks.pdf
Texas Education Agency. (2005). *Linguistically accommodated testing (LAT) supplement to the TAKS and SDAA II test administrator manuals Grades 3–8 and 10 mathematics*: Austin, TX: Author.
Thomas, W. P., & Collier, V. P. (2002). *A national study of school effectiveness for language minority students' long-term academic achievement*. Berkeley: Center for Research on Education, Diversity & Excellence, University of California, Berkeley.
Valenzuela, A. (2004). *Leaving children behind: How "Texas-style" accountability fails Latino youth.* New York City?: State University of New York Press.
Wright, W. E. (2004). What English-only really means: A study of the implementation of California language policy with Cambodian American students. *International Journal of Bilingual Education and Bilingualism, 7*(1), 1-23.
Wright, W. E. (2005a). English language learners left behind in Arizona: The nullification of accommodations in the intersection of federal and state policies. *Bilingual Research Journal, 29*(1), 1-30.
Wright, W. E. (2005b). *Evolution of federal policy and implications of No Child Left Behind for language minority students* (No. EPSL-0501-101-LPRU). Tempe, AZ: Language Policy Research Unit, Education Policy Studies Laboratory, Arizona State University. Available: http://www.asu.edu/educ/epsl/EPRU/documents/EPSL-0501-101-LPRU.pdf.
Wright, W. E., & Pu, C. (2005). *Academic achievement of English language learners in post Proposition 203 Arizona*. Tempe, AZ: Language Policy Research Unit, Educational Policy Studies Laboratory, Arizona State University. Available: http://www.asu.edu/educ/epsl/EPRU/documents/EPSL-0509-103-LPRU.pdf.

NOTES

[i] Data and figures calculated from State Report Cards in Education Week, 23(17), 124-153 (*Quality Counts, 2004*).
[ii] Exceptions to this policy can be made on a case-by-case basis at the school level.
[iii] Despite their age and grade-level difference, the school decided to put them both in the same 5th grade classroom so they would not feel isolated in their new school, and so they could provide each other with support.
[iv] For other ELLs, the opposite is true. Many students who come from middle and upper-class communities in Mexico, and many students from more economically advanced Asian countries such as Taiwan, Hong Kong, Japan, and Korea, actually find the level of math instruction in the United States to be lower than that of equivalent grade levels in their home countries. But the linguistic issues described later in this study still pose great challenges even for students with this advanced knowledge.
[v] The school used a much older version of Compass Learning products. See www.compasslearning.com for similar but more recent products.
[vi] Many of the textbook companies produce special "Texas Edition" versions of the math textbooks to ensure they are aligned to the Math TEKS.
[vii] The raw results of Web Vocabulary Profiler had to be cleaned up quite a bit (this is a slangy phrase—how about edited or modified significantly?) to remove repeated words, proper nouns (e.g., names of people in word problems), and non-words (e.g., single letters and abbreviations). Also, words sharing the same root (e.g., add, adding; count, counts) were combined and counted as one word for the purposes of this analysis. The results shown in Table 5 are after this clean-up procedure. Table 5 eliminates the first 500 function words (e.g.., high frequency words such as "the, am, is, it, on," etc…), as well as non-math words appearing in the off-list category.
[viii] Nitha in particular could actually decode text at a much higher grade level, and even attempted to read grade-level chapter books. However, her lack of English vocabulary meant she understood little of what she was reading.