Literacy development among New York City Latino students

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Introduction

Academic researchers and educators have been focusing on ways to improve literacy among students across schools in the United States. In particular, low rates of adolescent literacy have been cited as an urgent problem, as reported in the 2007 National Assessment of Educational Progress: "25 percent of eighth graders and 26 percent of twelfth graders were reading at 'below basic' levels in 2002. International comparisons of reading performance placed American eleventh graders very close to the bottom, behind students from the Philippines, Indonesia, Brazil, and other developing nations" (Kamil 2003).

While reported literacy gaps among native-English speaking students are worrisome, of even greater concern are gaps among English language learners (ELLs), those students for whom English is not a native language. For this group, the reading scores of fourth-grade ELLs were 36 points below non-ELLs; among eighth-grade ELLS, there was a 42 point gap, pointing to a major crisis in adolescent literacy among ELLs (Goldenberg 2008).

In the study reported in this paper, we investigate the literacy skills and progress among a group of adolescent ELLs who are particularly at-risk in our education system. These students are adolescent Spanish–speakers, with purported low levels of literacy in their native language,

who appear to have great difficulty learning English literacy and academic content. While these students represent a growing population in U.S. cities, so little is known about them that school systems continually struggle to find ways of developing appropriate instructional programs for this group. The study reported here is one of the first to assess the skills of this sub-group of ELLs, laying the groundwork for addressing their academic needs.

Effects of migration on adolescent literacy

Low literacy among adolescents poses a challenge to the American educational system, ultimately limiting academic and vocational opportunities for these students. Furthermore, English language learners (ELLs), who do not speak, read or write English proficiently, have been falling behind their English-speaking peers. This population has increased dramatically in the last years, from 2 million in 1990 to 5 million (or 1 in 9 children). By far, the majority of ELLs (80%) are Spanish speakers, mostly from Mexico and Central America (Goldenberg 2008).

Migration to the United States has increased the number of ELLs in secondary schools, especially. These students often face additional obstacles when adapting to academic life. Though low literacy remains a pervasive problem among English-speaking American high school students, ELLs additionally tend to lack the oral English proficiency necessary to develop literacy skills. In 2005, only 4% of ELLs tested in eighth grade were found to read at or above grade level on the National Assessment for Educational Progress, leaving them ill-prepared to complete high school (National Center for Educational Statistics 2005). 10% of students who speak English at home fail to complete high school, while for ELLs, the figure is 31%. For the ELLs who report difficulty speaking English, the graduation rate drops to 18% (Short & Fitzsimmons, 2007).

Compounding this problem are many ELLs who do not appear to have basic literacy skills in their native languages, although lack of systematic diagnostics in students' native languages suggests that this conclusion is largely anecdotal (Klein and Martohardjono 2006). When they enter American schools, these students are asked to comprehend complex course content. However, they often lack the requisite literacy skills and prior knowledge needed for academic success. In addition, adolescent ELLs have a compressed timeframe in which to master both the English language and required high school course content; this presents an enormous challenge, especially when course material is presented exclusively in English. In a recent report, (Goldenberg 2008) cites growing evidence that "proficiency in academic English can require six, seven or more years." This suggests that ELLs who enter school as adolescents are at a distinct disadvantage, with not enough time to succeed in learning English while trying to master secondary school material. Furthermore, ELLs with poor academic skills in the native language encounter far greater obstacles than other ELLs in developing English reading and writing skills and acquiring academic content knowledge (Klein and Martohardjono 2006).

While the number of ELLs in U. S. schools has increased dramatically, the number of ELLs with low academic skills has also grown proportionately over the past few years. Students entering American schools with inadequate prior academic preparation come from a variety of countries. In New York City (NYC), an urban center with an increasing number of these students, it is reported that their native languages most often include Spanish, Chinese, Bengali, Arabic, and Haitian Creole (Office of English Language Learners, NYCDOE 2007). These students are known in NYC as SIFE (Students with Interrupted Formal Education). According to the NYC Department of Education, SIFE comprise approximately 13.4% of the total ELL enrollment in NYC public schools, i.e. 18,900 SIFE out of 141,000 ELLs (DeCapua et al. 2007).

Spanish-speakers comprise 59% of the SIFE population in NYC, a figure indicative of many other American cities (Office of English Language Learners, NYCDOE 2007).

According to a report for the Alliance for Excellent Education (Feb, 2007), studies of adolescent ELLs, in general, are scarce: "[O]f 309 studies identified for review by the National Literacy Panel on Language-Minority Children and Youth, fewer than 30 focused on students in grades 6-12." DeCapua (2007) reports that even less research has addressed the needs of adolescent ELLs with low native language literacy.

Research on ELLs with low native language literacy: Transfer of skills

The majority of previous studies concerning low literacy ELLs have surveyed educational practices and programs, but have rarely explored the interaction between native language literacy and second language literacy in adolescents. For example, the 2003 Final National Conference for Educators of Newcomer Students and Pilot Study on Newcomer Program Literacy and Assessment Practices looked only at preexisting programs for ELLs, with "newcomers" referring to ELLs with low native language literacy. Among "[t]he goals of this 2-year project … were 1) to plan and convene a national conference for educators of newcomer students and 2) to conduct a pilot study on effective literacy and assessment practices in newcomer programs" (Short, Boyson, & Coltrane, 2003). This study did not include any original research, but rather, described existing programs and policies.

Chamot et al. (2000) conducted one of the only longitudinal studies on ELLs with low native language literacy. Chamot et al.'s study explored the efficacy of native language support in the acquisition of English language literacy and related cognitive abilities by tracking the

academic progress of 50-74[1] Spanish-speaking ELLs with low native language literacy over the course of one year. Participants were divided into two groups: one receiving English-only instruction, and the other receiving some native language literacy instruction. Students' performance in both Spanish and English was measured at the beginning and end of the school year to assess gains in literacy. While the English-only group in this study performed better on most measures of English language literacy at the end of the year, the group receiving Spanish literacy instruction made greater gains in higher-level cognitive skills and learning strategies (Chamot et al. 2000:134).

While their study was limited by some problems with research design and implementation, Chamot et al. (2000) nevertheless conclude that "… a certain level of native language literacy is necessary for optimal development of second language literacy," supporting earlier theories of so-called *transfer of skills* (e.g. Toukomaa and Skutnabb-Kangas 1977, Cummins 1981). The National Literacy Panel, as reported by Slavin and Cheung (2005) and August and Shanahan (2006), conducted a meta-analysis of 17 studies comparing instruction in students' first and second languages with instruction in second language only. August & Shanahan (2006: 234) conclude: "Cross-language correlations…have been widely interpreted as representing the transfer of higher level skills from the first language and language of instruction to the second language, providing support for bilingual education." This large study supports several earlier meta-analyses, most recently by the Center for Research on Education, Diversity and Excellence (CREDE) (reported in Genesee et al. 2006), that reached the same conclusion: Literacy in the home language promotes achievement in second language reading. Finally, in a

[1] This number fluctuated depending on how many participants took particular sections of the assessments given.

recent overview of studies and meta-analyses of studies involving transfer of skills, Goldenberg (2008:15) summarizes the findings in the field: "A substantial body of research suggests that literacy and other skills and knowledge transfer across languages. That is, if you learn something in one language, you either already know it in (i.e. transfer it to) another language or can more easily learn it in another language."

Assessing ELLs with low native language literacy

Transfer of skills from first to second languages has been strongly supported in the literature, with most studies conducted among the larger population of English language learners but few studies among students with low native language literacy (cf. Chamot et al. 2000; Klein & Martohardjono 2006). In order to determine their specific academic needs and provide appropriate instruction and materials for these ELLs, it is critical to assess the native language skills and academic knowledge these students bring with them when they enter schools in the U. S., especially those who may lack such competencies. Therefore, along with requests for more and better research on this population, recent calls for appropriate assessment instruments for ELLs have been growing.

In 2007, The Center for Applied Linguistics (CAL) Panel identified some critical issues facing ELL instruction, including: no common criteria for either identifying or tracking literacy; no appropriate assessments; no clearly-defined, strong research agenda. The panel also recommended ways of combating these issues, strongly urging the development of new assessments that test for three different aspects of competency: native language literacy, English language literacy, and content knowledge.

Short and Fitzsimmons (2007) recommend that proper assessments be given at the beginning of an ELL's school career, to determine each student's academic knowledge. In addition, similar assessments should be given throughout their schooling, to track their progress in both literacy and content knowledge. Both the diagnostic and the progress assessments should be given in the student's native language and in English. This will allow the educators to determine the native language literacy level as well as the English acquisition progress. The English assessments should be tailored and designed to evaluate different areas of progress, such as phonics, vocabulary, and reading comprehension. The native language assessments should not only cover literacy but each content area, such as science and mathematics.

In summary, without specialized assessment instruments and informed practices based on solid research, schools throughout the U.S. will continue to struggle to provide appropriate instructional support for ELLs, especially those with low native language literacy. The results of educational services for ELLs, in general, have thus far not been very successful, as many ELLs are leaving school. While the national dropout rates have been steadily decreasing, down to 3.8% total in 2005 (NCES June 2005), the dropout rates for ELLs are still extremely high: about 23% of ELLs age 16-24 are either not enrolled in school or do not have a high school diploma or the equivalent (Morse 2005:5). The drop-out rate for ELLs with low native language skills is not known, but can only be surmised as falling below that of other ELLs, thus reflecting a growing national problem.

In order to shed light on this problem, we conducted a study based in New York City, among the special population of ELLs labeled as SIFE. We want to know what makes this special population of immigrant students different from other, more typical, English language

learners. Specifically, what is the language and cognitive development of these students? Do the students evidence developmental problems, which could explain the difference between typical language learners and SIFE? Or is the difference between the populations due to a difference in academic language skills? In order to address this question, we need to determine the academic literacy skills in the native language of SIFE. Specifically, what skills in the native language do they bring with them to school in the US? How do their skills compare to those of their peer groups? Finally, does this population evidence transfer of skills from the native language to English, as suggested by the literature on other ELLs?

The Study

Participants: SIFE

As noted above, 59% of SIFE in New York City speak Spanish as their native language, the largest linguistic minority in the school district. Thus, we focused on this group in our study. Ninety-eight students identified as SIFE from five inner-city high schools in New York City participated in the study. The students, identified as SIFE by their schools and/or by the New York Department of Education, had been in the school system for less than a year.

The students ranged in age from fourteen to nineteen and were all placed in either the ninth or tenth grade in a New York City high school. The typical age of a student entering grade nine is fourteen and the typical age of a student entering grade ten is fifteen. As the US school system has primary school (K-5), middle school (6-8), and high school (9-12), the age of the students determines that they be placed in a school with their peers. However, students older than

fifteen who have been labeled as SIFE are not placed in eleventh or twelfth grade, as these grades would potentially prove to be much too advanced for them.

The five participating New York City high schools were chosen to participate in the study by the New York City Department of Education. These high schools differ in terms of how SIFE are instructed. Two of the five schools have sheltered SIFE programs, meaning that students labeled as SIFE share all of their classes, with their classes containing only other SIFE students and no other English language learners (ELLs) or native English speaking students. In the three schools where SIFE are not in sheltered programs, they attend mixed classes with other ELLs. Four of the five schools have some instruction in the native language.

Participants: Comparison Groups

In order to compare SIFE with their peers, we had two additional participant groups in our study. The first group consisted of thirty-eight native English speaking ninth graders from three of the high schools attended by the SIFE in our study. This helped control for demographics like socio-economic background, as students at a given high school are generally drawn from the same neighborhood.

The other comparison group consisted of twenty-two ELLs from one of the high schools attended by the SIFE in our study, similarly controlling for demographic factors. The students were in the ninth and tenth grades and had entered the New York City school system at the same time as the SIFE group. Thus, the ELL group and the SIFE group have been in the US for roughly the same amount of time, allowing for a valid comparison between them.

Materials and Procedures

The study was conducted over a period of eighteen months, with data collection done in two time periods. In Time One we administered assessments only to the SIFE group in their native language (Spanish) within their first year in US schools. In Time Two, one year later, we administered assessments to SIFE in both the native language and English. The English native speaker group and the ELL group were given assessments in English during Time Two.

We administered a large number of assessments, only some of which we are reporting in this paper:

1) Academic Language and Literacy Diagnostics (ALLD)

These diagnostics were developed by our research team since there were no appropriate assessments for adolescent English language learners with low native language literacy. They were based on standardized tests in Spanish and English with items carefully selected for this special population. The ALLD was administered in a group setting within students' classrooms over the course of several forty-five minute sessions. In a given session, test takers received a booklet with sets of multiple choice questions to answer. This test was given in Spanish at Time One and Time Two. At Time Two it was also given in English.

The ALLD assesses the following broad skills: pre- and basic literacy, reading vocabulary, reading comprehension. Each will be described in turn.

Pre- and basic literacy

This tests phonological and orthographic awareness, word reading and simple sentence comprehension.

Reading Vocabulary

This tests knowledge of synonyms, multiple meaning words and context clues.

Reading Comprehension

This tests the students' ability to read and understand passages, assessing 'basic understanding' and text level skills such as 'critical analysis', 'strategies' and 'interpretation'.

2) Syntax Test

The syntax assessment was developed by the research team to measure 'typical language development' of syntactic knowledge. It is a test of comprehension to ensure that these students did not have language comprehension problems in their native language, which could indicate cognitive impairment. The test was orally presented to a group of students. The students heard a sentence and had to match the sentence to one of three pictures they had in front of the. The sentences had complex syntactic structures, including coordination, subordination and adverbials. This test was given in Spanish during Time One and in English at Time Two.

3) Test of Oral Language Proficiency

To test students' oral language proficiency in both Spanish and English, we administered a standardized test.[2] This is an automated test of comprehension and production in which students are tested individually over the phone for a period of ten minutes. It tests the following components of oral language: sentence mastery, vocabulary, fluency and pronunciation.

4) Working memory tasks

[2] Versant test, Pearson

In order to determine the working memory of the students, we administered two tasks from a standardized test.[3] One involved word recall and the other involved reverse number recall. We administered these tasks to students individually to reveal potential cognitive or reading problems due to poor working memory.

Data Analysis

1) ALLD

For the pre- and basic literacy diagnostics, all taken from first grade level, we calculated the mean percent correct and standard deviation for all the skills tested.

For the vocabulary and reading comprehension sections of the ALLD, for each student we determined the mean percentage achieved at each grade level and calculated the overall grade level achieved for each of these skills.

2) Syntax Test

For the syntax test, we calculated the mean percent correct and standard deviation.

3) Test of Oral Language Proficiency

As this is an automated test, the scores are all calculated by a scoring program which is accessed though the ordinate website. Once all of the students have completed the tests, the scores are downloaded into an excel workbook.

4) Working Memory

[3] Bateria III, Riverside Publishing

The scores on these standardized tests are calculated by a scoring program. The scoring software outputs a score report for each student.

Results: Time One

1) ALLD

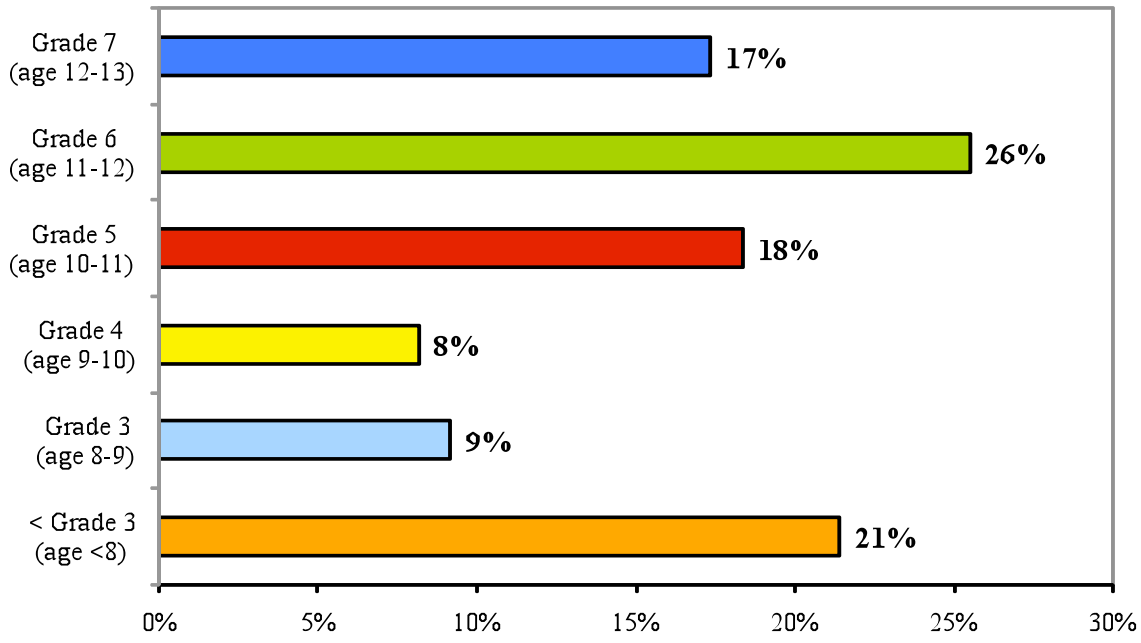
Pre- and Basic Literacy:

The students had a mean score of 96% correct on the basic literacy section of the ALLD, with a standard deviation of only 4.5. Thus, the ninety-eight students in the SIFE group have basic literacy skills and are able to decode words and read simple sentences.

Reading Vocabulary:

The vocabulary section of the ALLD consists of items from grade level three through seven. Figure 1 represents the number of students performing at each grade level.

Figure 1: Spanish Vocabulary Results: Percentage of SIFE Scoring at Each Grade Level



As Figure 1 shows, the students' abilities in reading vocabulary vary widely, as their scores are distributed across several grade levels. The majority of students (56%) are scoring at fifth grade level or below, and almost a quarter (21%) of this group are scoring below third grade. Recall that these students are enrolled in the ninth and tenth grades, so they are generally four grades below the expected level in their knowledge of reading vocabulary in their native language.

Reading Comprehension:

The reading comprehension section of the ALLD consists of items from grade level two through five. Figure 2 represents the number of students performing at each level.

Figure 2: Spanish Reading Comprehension Results: Percentage of Students Scoring at Each Grade Level

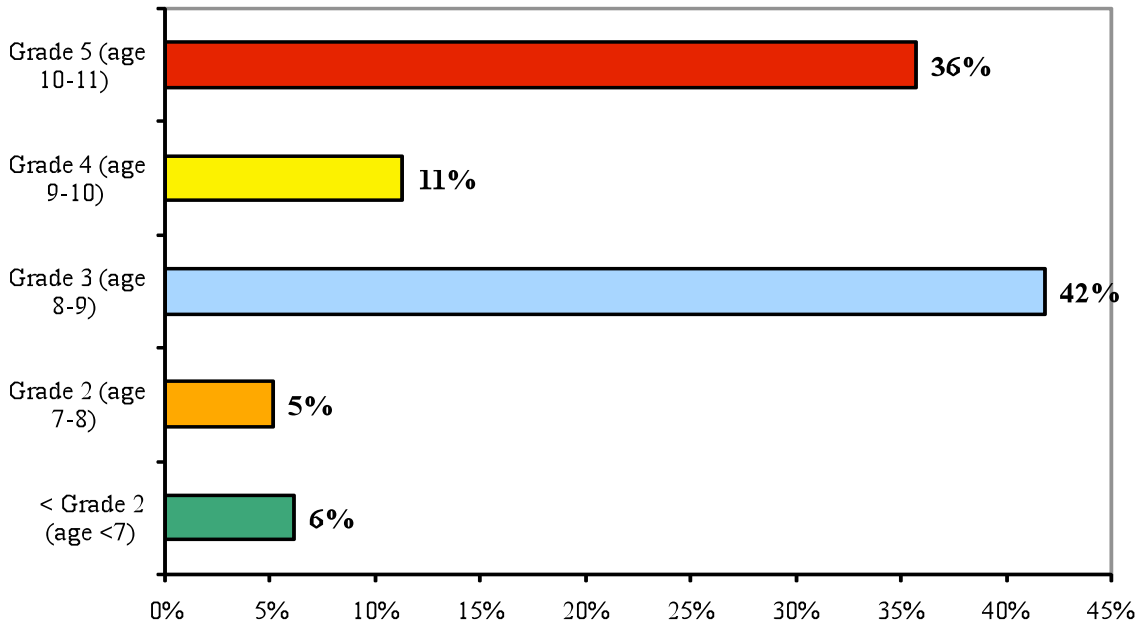


Figure 2 indicates that the students' performance on the reading comprehension section of the assessment is lower than their performance on the vocabulary section, and is less widely distributed across different grade levels. The majority of the students (53%) are performing at or below the third grade level on reading comprehension in their native language. Thus, the students are generally six grade levels below the expected level of ninth grade.

2) Spanish Syntax Test

The students had a mean score of 89% correct on the Spanish syntax test, with a standard deviation of 12. This indicates a normal range of native language syntactic comprehension, suggesting that the students do not have any developmental language problems in Spanish.

3) Spanish Oral Language Test

The students had a mean overall score of 80% correct on the oral language test, with a standard deviation of 16. The scoring program describes this score as indicating "fluent, smooth, intelligible speech; controls appropriate language structure for speaking about complex material". These results indicate typical language development in their native language.

Results: Time Two

1) Spanish ALLD

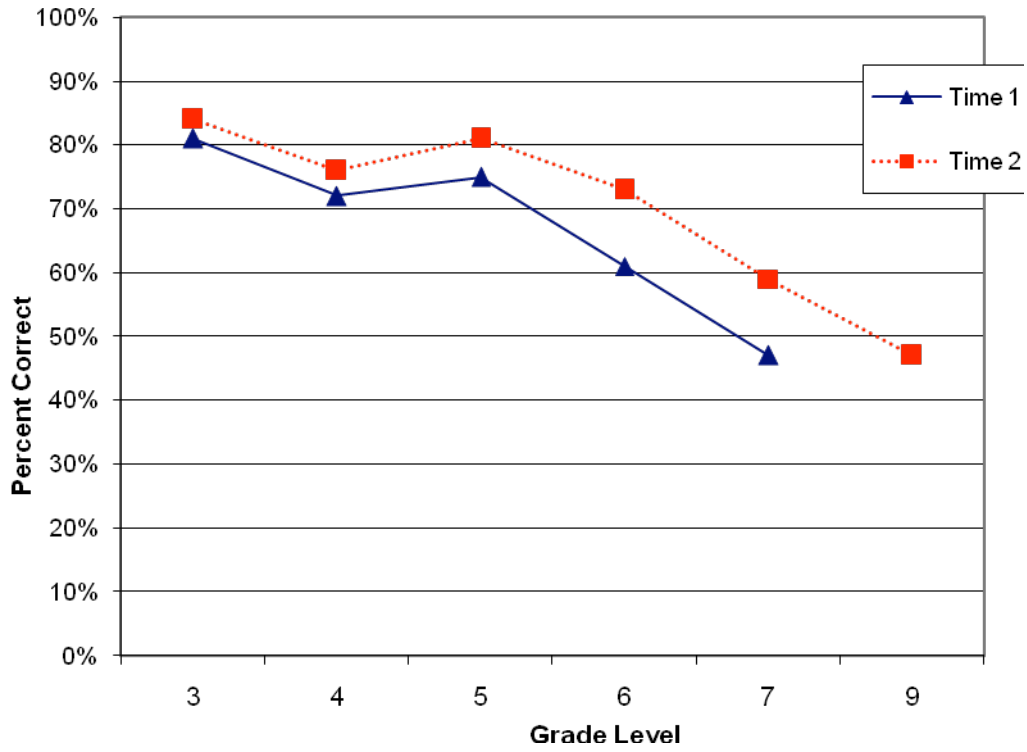
Due to very high attrition rates, the SIFE group was reduced from 98 students in Time One to only 49 students in Time Two. In reporting the Spanish ALLD results, we will compare Time One performance with that of Time Two for those remaining students, in order to measure gains the students made in native language skills over one year.

Reading Vocabulary:

The reading vocabulary section of the ALLD for Time Two consists of items from grade level three through nine.[4] Figure 3 represents the mean score on each grade level during both Time One and Time Two.

[4] This contrasts with the maximum grade level for Time One, where the maximum grade level tested was lower, i.e. grade seven.

Figure 3: Spanish Reading Vocabulary Results: Time One Grade Level Performance compared to Time Two Grade Level Performance (N=48)

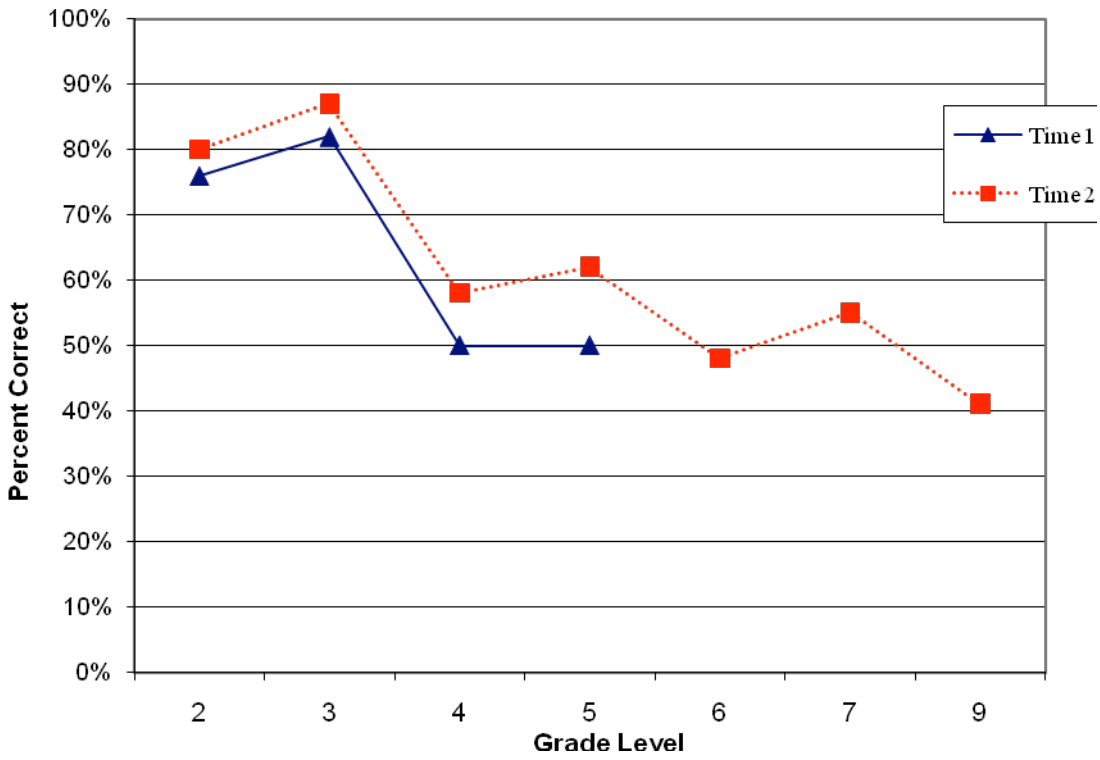


In Figure 3, scores for Spanish Reading Vocabulary during Time One are shown as a solid line with triangles representing data points across grade levels three to seven. Time Two scores are shown in a dotted line with squares representing data points up to grade nine. Results show that students improved in their performance in reading vocabulary in the native language in every grade level. The higher grade levels (grades six and seven) show about a 15% increase in scores. The difference between Time One and Time Two is significant at the seventh grade level ((t(47)=2.576; p = .01) The mean grade level score of students on the vocabulary section of the ALLD was 6.5, as compared to the mean grade level score of 5 during Phase One.

Reading Comprehension:

The reading comprehension section of the ALLD consists of items from grade level two through nine.[5] Figure 4 represents the mean score on each grade level during both Phase One and Phase Two.

Figure 4: Reading Comprehension Results: Time One Grade Level Performance compared to Time Two Grade Level Performance



In Figure 4, scores for Spanish Reading Comprehension at Time One are shown in a solid line with triangles representing data points across grade levels two to five. Time Two scores are shown in a dotted line with squares representing data points up to grade nine. Results show that students improved in their performance in reading comprehension in the native language in every

[5] This contrasts with the maximum grade level for Time One, where the maximum grade level tested was lower, i.e. grade five.

grade level tested, that is up to grade five, the highest grade level tested at both time periods. The difference between Time One and Time Two is significant at the fifth grade level ($t(47)=2.933$; $p < .01$)The mean grade level score of students on the reading comprehension section of the ALLD was 5, as compared to the mean grade level score of 3.7 during Time One.

2) English Syntax

The mean percent correct on the English syntax test was 64%, with a standard deviation of 16. The students are still in the beginning stages of acquiring complex syntactic structures in English.

3) English Oral Language Proficiency

The mean percent correct overall on the test of English oral language proficiency was 34%, with a standard deviation of 9. The scoring program describes this score as indicating that the student "can manage some slow, short, isolated utterances, or spoken formulas, but has difficulty following any native conversation; test-taker may often pause to search for words and may be difficult to understand."

4) Working Memory Task

We administered the working memory task to twenty-three of the students. Their scores indicate that 78% of them have average working memories, indicating no general cognitive problems due to working memory.

Results: SIFE and Comparison Groups

In order to examine how SIFE compare to their peers in their English reading skills as shown in the same tests, the ALLD was administered to all the groups in our study.

1) English ALLD

The ALLD was administered to the Native English speaker group in English, their native language. It was also administered to the ELL group and the SIFE group in English, their second language. See Figure 5 for a comparison of performance on the vocabulary and reading comprehension sections of the English ALLD.

Figure 5: Grade Level Performance on English Language Vocabulary and Reading Comprehension by Three Groups: Native English Speakers (NES), English Language Learners (ELLs) and SIFE

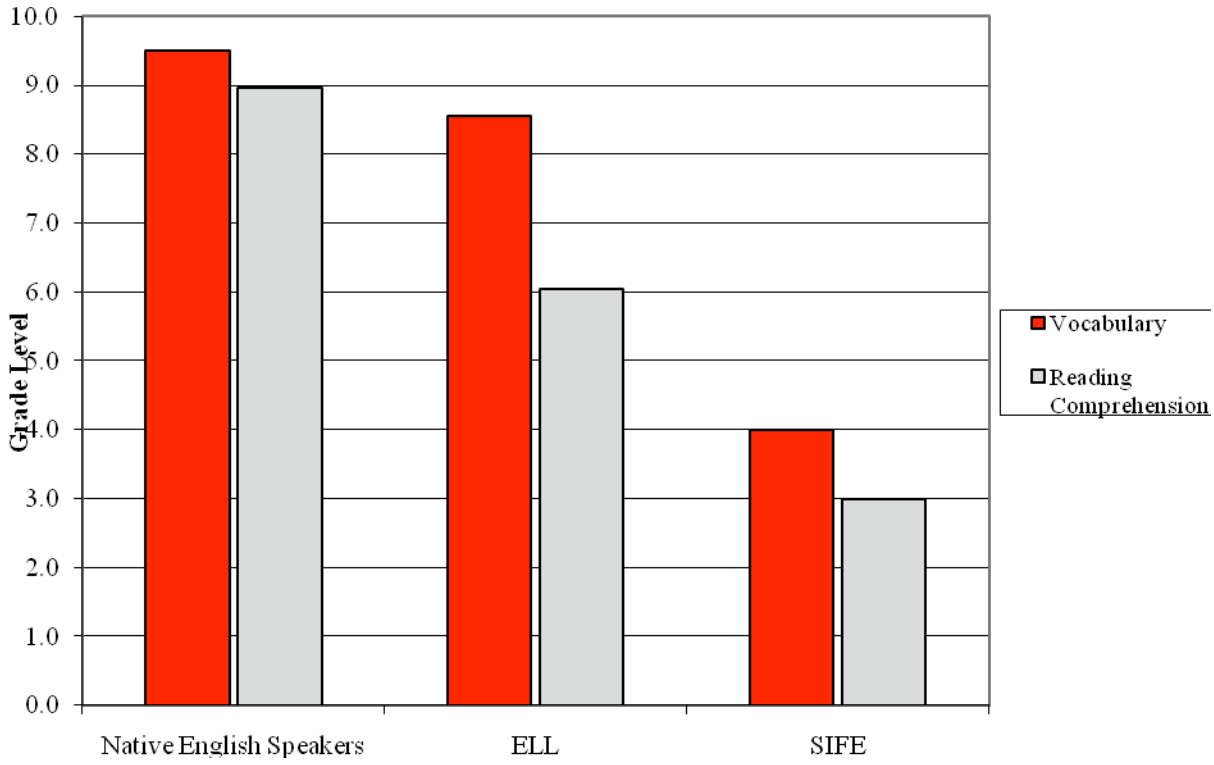


Figure 5 shows the NES group performing at grade level in both reading vocabulary and reading comprehension, while both ELL groups are performing below their expected grade level. However, the SIFE group is 4.5 grade levels below the ELL group in English vocabulary and 3 grade levels below the ELL group in English reading comprehension. It is important to emphasize that both non-native English groups have been attending school in the US for the same length of time, which suggests that the time spent learning English has been approximately the same for both groups.

Results: Comparison of Spanish and English Skills

The data we have reported here show that the SIFE students come to school with very low academic skills in their native language. After being in the US for one year, they test at roughly the same grade level in English as they did in Spanish when entering the school system. We now question whether there is a relationship between their reading comprehension in the native language and English reading comprehension, considering the extensive evidence for transfer of skills as reported in the Introduction of this paper. We report below correlations between English reading comprehension and Spanish reading comprehension at both Time One and Time Two.

Table 1: Reading Comprehension Correlations

English x Spanish Time One	English x Spanish Time Two
$r = .519$ $p < .001$	$r = .574$ $p < .001$

Table 1 shows the correlations between English reading comprehension and Spanish reading comprehension. The results indicate a strong relationship between second language reading comprehension and native language reading comprehension at both Time One and Time Two. This suggests that the students are able to transfer their literacy knowledge from the native language to English, even when that knowledge is low, providing further evidence for transfer of skills among this special group of ELLs.

Discussion

The results reported above suggest that SIFE are a unique, struggling population of adolescent English language learners. They come to secondary school with very low literacy skills in their native language. They perform significantly lower on an English literacy assessment than the more typical English language learners who have been acquiring English for the same amount of time. Thus, the literacy gap is even greater among this struggling population of students than it is for other English language learners. This makes students with low native language literacy, represented in our study by the SIFE population, drastically at-risk in their development of the English literacy skills necessary for success in US high schools. However, their struggle does not seem to be a result of a language disability, a reading disability, or memory problems. The students show typical development in the native language, basic literacy skills in the native language, and average working memories.

The struggle appears to be related to a low level of academic skills in the native language, limiting the development of second language skills. This theoretical conclusion can help inform the practices of US high schools in order to better prepare adolescent students with low native language literacy for academic success. Among our group of adolescent at-risk learners, it

appears that the students are able to transfer their skills; the better readers in the native language are also the better readers in English. Also, over the course of one year, the at-risk learners make significant gains in their native language skills (recall that four of the five schools have classes in Spanish, which explains gains in the native language). Thus, we conclude that raising literacy levels in the native language will positively impact literacy in the second language, helping the students gain the many skills they need, in the short time they have.

This conclusion is in line with the findings and recommendations of Chamot et al. (2000) for students like SIFE. It also supports the recommendations of August and Shanahan (2006), Slavin and Cheung (2005), and Genessee et al (2006) for the instruction of other English language learners. Strengthening a student's academic and literacy skills in the native language will aid the student's acquisition of literacy and academic skills in a second language.

This increasing body of research supporting native language instruction should be taken into account when planning instruction, in order to help close the gap between English language learners with low native language literacy and their adolescent peers. Other instructional recommendations, including appropriate identification and placement of these students also follow from this research.

Our research suggests that the students could benefit from *accelerated* instruction in their native language, while at the same time learning English as a second language. The data we have reported here suggest that the students can acquire the necessary skills at an accelerated pace, having gained 1.5 grade levels in both Spanish vocabulary and reading comprehension over the course of one academic year. With bilingual classes and English language instruction specifically tailored to their unique needs, it is likely that their progress could be accelerated even more.

Up to now, appropriate identification and placement of students like SIFE have been severely hampered by a lack of diagnostic and assessment instruments for adolescents in their native language. That is, US high schools have not been able to identify at-risk English language learners. As there have been no systematic assessment tools for identifying students with low native language literacy, these students have not been receiving instruction tailored to their needs. Now that we have more data on the skills of this population, in comparison with most other English language learners, we can begin to identify struggling English language learners. Based on the results reported here, it appears that the struggling readers bring reading comprehension skills at least four years below their expected grade level. This large gap should be used in identifying the students who have low native language literacy skills. This is in line with the suggestion made by Short and Fitzsimmons (2007) that proper assessments be given at the beginning of an ELL's school career to determine the student's academic skills in the native language. Furthermore, the 2007 CAL Panel recommended that there be common criteria for identifying and tracking literacy. Our assessment is a good start in addressing these issues, and is one of the first appropriate diagnostic assessments for ELLs, in that it tests for native language literacy and English language literacy, along with content knowledge[6] (as suggested by the CAL Panel).

Although we now know more about this struggling group of students and have developed an assessment tailored to this adolescent population, more research and more assessment tools are needed. We have begun by investigating the skills and progress of a Spanish speaking student

[6] The content area section of the ALLD, which specifically tests knowledge of mathematics, was not discussed in this paper.

population, but research among other native language groups, with proper assessments in other languages, is sorely needed.

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