Impact of Selected Background Variables on Students' NAEP Math Performance

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Jamal Abedi, Carol Lord, and Carolyn Hofstetter
CRESST/University of California, Los Angeles

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Center for the Study of Evaluation
National Center for Research on Evaluation,
Standards, and Student Testing
Graduate School of Education & Information Studies
University of California, Los Angeles
Los Angeles, CA 90095-1522
(310) 206-1532

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IMPACT OF SELECTED BACKGROUND VARIABLES ON STUDENTS' NAEP MATH PERFORMANCE

Jamal Abedi, Carol Lord, and Carolyn Hofstetter

CRESST/University of California, Los Angeles

EXECUTIVE SUMMARY

The reauthorization of the Elementary and Secondary Education Act (ESEA) legislation, through the enactment of the Improving America's Schools Act (IASA) of 1994, represents a significant shift in expectations for American students. Compensatory education funding is provided through programs such as Title I and Title VII of the IASA, which now state that all children are expected to attain challenging standards set by their own state. The intent is that all children be given educational experiences to assist them in achieving high standards. Moreover, the operational consequence of these new, standards-based reforms is that children previously excluded from assessments because of physical or psychological disability or because of limited proficiency in English (LEP) are now to be included. This raises complex issues. If the goal of "challenging standards for all children" is to be met, there must be serious efforts to ensure that previously excluded students will have the opportunity to participate in these assessments.

The National Center for Research on Evaluation, Standards, and Student Testing (CRESST) investigated some of these issues in a set of empirical studies exploring effective and practical approaches to assessment modification and their implications for validity. The goal was to produce and analyze a series of test accommodations and modifications that may be appropriate and feasible for use in NAEP. Further, these studies may help improve procedures for matching students to modified measures, at least for students whose first language is Spanish. The overall intention of these studies was to use experimental methods to compare modified test versions with appropriate comparison groups of students with limited English proficiency.

The current study examines the impact of students' background variables on their National Assessment of Educational Progress (NAEP) math performance. More specifically, is NAEP math performance affected by students' background characteristics? If so, what background characteristics have the greatest impact on math performance? To address these questions, secured NAEP math items were administered to 1394 eighth-grade students (ages 13 to 14 years) in southern California middle schools during August and September 1996. Efforts were made to target and select schools with large Spanish-speaking student enrollments, sizable LEP student populations, and student populations representing varying socioeconomic, language and ethnic backgrounds.

Three test booklets were developed (original English, linguistically modified English, original Spanish). All booklets contained the same math items, differing only in their linguistic demands. During the linguistic modification process, only linguistic structures and nontechnical vocabulary were modified; mathematics vocabulary and math content were retained. One of the test booklets was administered randomly to each eighth-grade student in intact math classrooms. Randomization was conducted to minimize class, teacher, and school effects, and other possible sources of threat to internal validity due to selection. Students also completed a NAEP reading proficiency test and a background questionnaire, where students self-reported their English and native language proficiency, country of origin, number of years in the United States, and other related background information.

Preliminary analyses suggested that students performed highest on the modified English version, lower on the original English version, and lowest on the Spanish version of the math assessment. Additionally, non-LEP (fluent English proficient, initially fluent in English) students performed better on the math test than LEP students, both in general and across test forms. A two-factor analysis of variance design suggested significant differences ($p < .01$, unless otherwise stated) in math performance by LEP status and test booklet type, as well as a significant interaction effect between the two factors. These results were maintained even after controlling for students' reading proficiency. Finally, students may have performed lower on the Spanish version because, in most cases, the language of instruction was English only or sheltered English. Additional analyses suggested that students tend to perform best on math tests that are in the same language as their math instruction.

The results of this study also indicate that clarifying the language of the math test items helped all students improve their performance. Item-level analyses indicated that language modification of items helped students improve their performance in 49% of the math items for which a modified version was created. Certain types of linguistic modifications may have contributed more than others to the significant math score differences. Preliminary item-level analysis suggests that item length may have had a stronger impact than other complexity variables, for example. Further item-level analyses are being conducted to identify any patterns of differential impact of linguistic modifications.

Multiple regression analyses predicting math and reading scores from students' background questions indicated that language-related background variables, such as length of time of stay in the United States, overall grades since 6th grade, and the number of times the student changed schools, are good predictors of students' performance in math and reading. Approximately 35% of the variance on the math test and 27% of the variance on the reading test were predicted from 19 background variables used as predictors. Length of time residing in the United States was the strongest predictor of students' performance in math. These results indicate that students' background variables are important indicators in interpreting the assessment results for students with limited English proficiency.

Analyses of the language background questionnaire indicated that there are structural differences between LEP and non-LEP students on the relationship between the self-reported background questions, particularly in the language background variables. Students with limited English proficiency seem to have more difficulty reading and understanding the background questions. Reliability coefficients (internal consistency coefficients) were significantly lower for LEP students, indicating additional sources of measurement error for LEP students, perhaps due to language proficiency. Collectively, these findings suggest that students' background characteristics, especially with regard to English language proficiency, length of time in the United States, and academic schooling, are important predictors of performance, especially among students with limited English proficiency.

Implications

These findings have numerous implications for developing selection criteria for participation in the NAEP math tests, as well as accommodation strategies for students with limited English proficiency.

- Students' proficiency in academic English may be a suitable indicator of preparedness for participation in the NAEP math tests. A language proficiency measure is an essential component of LEP instruction and assessment. With such information, accommodations could be suggested for students based on their English language proficiency.

- Student background variables may serve as indicators of preparedness for participation in the NAEP math tests, including length of time a student has lived in the United States.

- Linguistically clarified test items may be used as a form of math test accommodation for LEP students. Further, it appears that all students, both LEP and non-LEP, would benefit from more clearly worded math items. Language, however, is especially confounding for students designated as LEP.

- Translating assessment tasks into the students' native language is frequently assumed to be a good accommodation strategy. Our data suggest otherwise. Translating test items from English to other languages may not necessarily accommodate LEP students when their language of instruction is English. In summary, the data suggest that students perform most effectively when the language of the math test matches their language of math instruction.

Recommendations

Based on the findings of this study, as well as existing research on developing and analyzing test accommodations for English language learners, specifically students designated as Limited English Proficient (LEP), we recommend additional, systematic research on the following:

- If LEP status is used as part of the selection criteria, a more objective, nationwide operational definition of the term "limited English proficiency" is needed. Usage of the student designation "Limited English Proficient" (LEP) proved problematic due to arbitrary and varying classification criteria across schools. Thus, students designated as LEP at one school may not be designated as LEP at another school. This has implications for which students are included in the NAEP testing.

- The current analyses are based on a total sample of LEP and non-LEP students. Math performance, native language proficiency, and English proficiency may vary among subgroups of students by native language (e.g., Spanish, Vietnamese, Cambodian). Additional analyses are necessary to identify possible differences in the effect of language accommodations on different subgroups.

- More attention should be given to the feasibility of administering different forms of accommodations for LEP students. If the most effective form of accommodation is not practical or logistically possible, it may not be useful. Thus, our recommendation is to build in the "feasibility factor" as one of the main research issues in any studies dealing with accommodations for any group of students.

The above recommendations are based on several studies conducted at UCLA/CRESST. However, caution must be exercised in using these recommendations, since the studies are based on a relatively small sample (an $\underline{n}$ of approximately 1400 students in each of our studies) and non-nationally representative subjects.

IMPACT OF SELECTED BACKGROUND VARIABLES ON STUDENTS' NAEP MATH PERFORMANCE

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CRESST/University of California, Los Angeles

Abstract

The effects of students' background characteristics on their NAEP math performance was examined in this study. Secured NAEP math items were administered to 1394 8th grade students from schools with large Spanish-speaking student enrollments, sizable LEP student populations, and varying socioeconomic, language and ethnic backgrounds.

Three test booklets were developed (original English, linguistically modified English, original Spanish) using the 1996 NAEP Grade 8 Bilingual Mathematics booklet. The three booklets were randomly assigned to the students within a given class. All booklets contained the same math items, differing only in their linguistic demands. During the linguistic modification process, only linguistic structures and non-technical vocabulary were modified; mathematics vocabulary and math content were retained.

The results of our analyses suggested that students performed highest on the modified English version, lower on the original English version, and lowest on the Spanish version of the math assessment. Additionally, non-LEP (fluent English proficient, initially fluent in English) students performed better on the math test than LEP students, both in general and across test forms. These results were maintained even after controlling for students' reading proficiency. Finally, students may have performed lower on the Spanish version because, in most cases, the language of instruction was English only or sheltered English. Additional analyses suggested that students tend to perform best on math tests that are in the same language as their math instruction.

The results of this study also indicated that clarifying the language of the math test items helped all students improve their performance. Certain types of linguistic modifications may have contributed more than others to the significant math score differences.

Multiple regression analyses, predicting math and reading scores from students' background questions, indicated that language-related background variables, such as length of time of stay in the United States, students' grade point average, and the number of times the student changed schools, are good predictors of students' performance in math and reading.

Introduction

The reauthorization of the Elementary and Secondary Education Act (ESEA) legislation, through the enactment of the Improving America's Schools Act (IASA) of 1994, represents a significant shift in expectations for American students. Compensatory education funding is provided through programs such as Title I and Title VII of the IASA, which now state that all children are expected to attain challenging standards set by their own state. The intent is that all children be given educational experiences to assist them in achieving high standards. Moreover, the operational consequence of these new standards-based reforms is that children previously excluded from assessments because of physical or psychological disability or because of limited proficiency in English are now to be included. This raises complex issues. If the goal of "challenging standards for all children" is to be met, there must be serious efforts to ensure that previously-excluded students will have the opportunity to participate in these assessments (August & Hakuta, 1997; LaCelle-Peterson & Rivera, 1994; Zehler, Hopstock, Fleischman, & Greniuk, 1994).

These legislative changes also have major implications for large-scale testing programs, such as the National Assessment for Educational Progress (NAEP). Considerable variation in the percentages of students participating in the NAEP has been reported, based on varying interpretations of the inclusion criteria (Goldstein, 1997; Mazzeo, 1997; Olson & Goldstein, 1997), suggesting that many excluded students with limited English proficiency (LEP)[1] could have participated in the NAEP (Stancavage, Godlewski, & Allen, 1994). Thus, the

[1] The term "limited English proficient" (LEP) is used primarily by government-funded programs to classify students, and by the National Assessment of Educational Progress (NAEP) for determining inclusion criteria. We acknowledge that this term may have a negative connotation, and that the broader term "English language learner" (ELL) is preferred (see LaCelle-Peterson & Rivera, 1994; Butler & Stevens, 1997). However, in keeping with its widespread use in NAEP testing, we used "limited English proficient" (LEP) to refer to students who are not native English speakers and who are at the lower end of the English proficiency continuum. Classification in this study is based on student background information obtained from participating schools.

validity of inferences drawn from NAEP findings depends strongly upon the degree to which the sample represents fairly the distribution of all students in our nation.

However, the goal of increasing inclusion in NAEP or any other large-scale assessment requires a complex set of practical and technical decisions, and the systematic research in support of these choices is thin. Such decisions should be informed by knowledge such as the following:

- What methods are used to select students for alternative assessments—that is, assessments that are adapted, accommodated, or otherwise modified to meet student needs?

- What theories underlie the assessment modification concepts—that is, why are they expected to work?

- What degrees of modification have been undertaken?

- How and when should special validity studies be conducted to assure comparable measurement of the standards assessed by the unmodified versions?

The National Center for Research on Evaluation, Standards, and Student Testing (CRESST) investigated some of these issues in a set of empirical studies exploring effective and practical approaches to assessment modification and their implications for validity. The goal was to produce and analyze a series of test accommodations and modifications that may be appropriate and feasible for use in NAEP. Further, these studies may help improve procedures for matching students to modified measures, at least for students whose first language is Spanish. The overall intention of these studies was to use experimental methods to compare modified test versions using appropriate comparison groups of students with limited English proficiency.

To meet these goals, the studies were divided into two phases. Both phases replicate and build on earlier research on the effects of language background on mathematics performance among eighth-grade students (Abedi, Lord, & Plummer, 1995). Several additional changes have been incorporated: (a) greater focus on students with limited English proficiency; (b) improved rubric for linguistically modifying accommodated math test items (e.g., Modified English language); (c) inclusion of a measure of English reading proficiency, to better relate the impact of language factors on math performance; and (d) examination of the validity of different accommodations for students with limited English proficiency. Findings from the first phase are reported here, focusing on two research issues:

- Is NAEP math performance affected by students' background characteristics?
- If so, what background characteristics have the greatest impact on math performance?

Literature Review

Previous research has examined the relation between English language proficiency and content-based performance among both native and non-native English speakers. Several issues have been identified, including differential performance of language minority and language majority students in subject areas such as mathematics and science; the impact of language background factors on math performance; and the relative difficulty of linguistic structures in the language of test items. Each of these areas is elaborated below.

Math Performance Among Language Minority Students

Achievement differences between language minority and language majority students have been documented (see Cocking & Chipman, 1988). Language minority students (including Native American and Hispanic students) tend to score lower than language majority students on standardized tests of mathematics achievement at all grade levels, as well as on the Scholastic Aptitude Test (SAT) and the quantitative and analytical sections of the Graduate Record Examination (GRE). Although there is no evidence to suggest that the basic abilities of minority students are different from those of language majority students, many researchers speculate that the differential performance may be due in part to differences in English language proficiency.

Language proficiency appears to be a contributing factor in problem solving; student performance on word problems is generally 10-30% below that on comparable problems in numeric format (Carpenter, Corbitt, Kepner, Linquist, & Reys, 1980; Cummins, Kintsch, Reusser, & Weimer, 1988; Noonan, 1990; Saxe, 1988). Further evidence of the importance of language was demonstrated by

Cocking and Chipman (1988), who found that Spanish-dominant students scored higher on the Spanish version of a math placement test than on the same test in English. Additionally, Macnamara (1966) found that bilingual students showed lower performance when the language of instruction was in the students' weaker language. Evidence suggests that bilingual students keep pace with monolinguals in mechanical arithmetic but fall behind in solving word problems. This discrepancy may be due to language minority students reading their second language more slowly.

Mestre (1988) compared bilingual Hispanic ninth-grade students with monolingual students with the same level of mathematical sophistication and concluded that language deficiencies can lead to the misinterpretation of word problems. Mestre identified four proficiencies in language that interact to produce knowledge in the mathematics domain: proficiency with language in general, proficiency in the technical language of the domain, proficiency with the syntax and usage of language in the domain, and proficiency with the symbolic language of the domain. Mestre concluded that the ability to understand written text is of paramount importance in solving math word problems.

Impact of Background Factors

Previous research in a variety of fields, including second language acquisition, content area learning in a second language, and linguistic minority testing suggest that selected background factors, especially for language minority students, can threaten the validity of content-based assessments. A student's performance may be influenced by language background factors such as English language proficiency in academic contexts (Butler & Stevens, 1997). Thus, students' language background must be taken into account, as noted in the *Standards for Educational and Psychological Testing* (American Educational Research Association, American Psychological Association, & National Council for Measurement in Education, 1985, p. 73):

> Individuals who are familiar with two or more languages can vary considerably in their ability to speak, write, comprehend aurally, and read in each language. These abilities are affected by the social or functional situations of communication. Some people may develop socially and culturally acceptable ways of speaking that intermix two or even three languages simultaneously. Some individuals familiar with two languages may perform more slowly, less efficiently, and at times, less accurately, on problem-solving tasks that are administered in the less familiar language. It is

important, therefore, to take language background into account in developing, selecting, and administering tests and in interpreting test performance.

Although students may develop social skills in English fairly quickly, development of cognitive/academic language proficiency (CALP) or school language proficiency may take five to seven years (Cummins, 1984, 1989; Ramirez, Yuen, Ramey, & Billings, 1991). Compared with students who are continuously exposed to standard academic English, students from homes where English is not spoken, where little or a limited amount of English is spoken, or who are in situations where there is little opportunity to acquire academic English would be expected to score lower on content-based assessments conducted in English. Thus, test scores may likely underestimate the students' potential until there has been at least seven years of exposure to English in an academic context (Cummins, 1984). Furthermore, linguistic and cultural discontinuities between the school and the home may be present; for example, research on Crow, a Native American language, suggests that some mathematical concepts may be regarded as having little relevance outside of school, and terms for these concepts may be recent introductions to the Crow language (Davison & Schindler, 1988).

Research suggests that fully bilingual students who attain high levels of proficiency in both their native and second languages are most likely to succeed on assessments in either language, especially the stronger language (Cummins, 1980). Partial bilinguals who are proficient in their native language, but not in the second language, will likely perform more poorly if the assessment is in their weaker language. This occurs due to less efficient language processing (Dornic, 1979), especially under adverse environmental conditions such as a noisy room (Figueroa, 1989). Finally, limited bilinguals who develop less than native-like ability in either of the two languages are most likely to experience academic underachievement and poor test performance, regardless of the language of the test (Cummins, 1981). Some students who are bilingual speakers, but not bilingual readers, may read at a slower rate in their second language (Chamot, 1980). These students may be negatively impacted by speed tests that involve reading (Mestre, 1984).

Thus, as most standardized, content-based tests are conducted in English and normed on native English speaking test populations, they may function as English language proficiency tests. English language learners (either native or non-native English speakers) may be unfamiliar with scriptally implicit questions, may not recognize vocabulary terms, or may mistakenly interpret an item literally (Duran, 1989; Garcia, 1991). Additionally, a student's first language can interfere; for example, Schmitt and Dorans (1989) found that Hispanic students scored higher than Anglo students on Scholastic Aptitude Test questions with "true" cognates (e.g., *metal*, which has the same meaning in both Spanish and English), while they scored lower on "false" cognates (e.g., *pie*, which means "foot" in Spanish).

These factors are likely to reduce the validity and reliability of inferences drawn about students' content-based knowledge, as stated in the *Standards for Educational and Psychological Testing* (American Educational Research Association et al., 1985, p. 73):

> For a non-native English speaker and for a speaker of some dialects of English, every test given in English becomes, in part, a language or literacy test. Therefore, testing individuals who have not had substantial exposure to English as it is used in tests presents special challenges. Test results may not reflect accurately the abilities and competencies being measured if test performance depends on these test takers' knowledge of English. Thus special attention may be needed in many aspects of test development, administration, interpretation, and decision-making.

Linguistic Variables Affecting Math Performance

Minor changes in the wording of math problems can raise student performance (Abedi, Lord, & Plummer, 1995; Cummins et al., 1988; De Corte, Verschaffel, & DeWin, 1985; Hudson, 1983; Riley, Greeno, & Heller, 1983). According to De Corte, Verschaffel, and DeWin (1985), rewording a verbal problem can make the semantic relations more explicit without affecting the underlying semantic and mathematical structure; the reader is then more likely to construct a proper problem representation and consequently to solve the problem correctly. What textual characteristics contribute to the relative ease or difficulty with which the reader constructs a proper problem representation?

Research has identified several linguistic features that appear to contribute to the difficulty of a text; they slow down the reader, make misinterpretation more likely, or add to the reader's cognitive load and thus interfere with concurrent tasks. In addition, certain linguistic variables have been found to correlate with difficulty; these variables may or may not be considered to be the *causes* of the difficulty, but they may serve as convenient *indexes* for the actual causes of the difficulty and can therefore be used to predict difficulty.

Indexes of language difficulty include word frequency, word length, and sentence length. An additional index of difficulty for word problems is length of item. These indexes are elaborated below. Following them is a discussion of linguistic features that may cause difficulty for readers; these include passive voice constructions, long noun phrases, long question phrases, comparative structures, prepositional phrases, sentence and discourse structure, clause types, conditional clauses, relative clauses, and concrete vs. abstract or impersonal presentations.

These features are relevant for English prose text in general, including math word problems. However, math word problems constitute a special genre with its own peculiarities of vocabulary and syntax (Aiken, 1971, 1972; Chamot & O'Malley, 1994; Cocking & Chipman, 1988; Munro, 1979; Rothman & Cohen, 1989; Spencer & Russell, 1960); a more comprehensive review of this literature is found in a previous language background study (Abedi, Lord, & Plummer, 1995).

Word frequency/familiarity. Word frequency was an element in early formulas for readability (Dale & Chall, 1948; Klare, 1974). Words that are high on a general frequency list for English are likely to be familiar to most readers because they are encountered often. Thus, frequency is a useful index for familiarity of the word and concept. Readers who encounter a familiar word will be likely to interpret it quickly and correctly, spending less cognitive energy analyzing its phonological component (Adams, 1990; Chall et al., 1990). Word frequency has been identified as a primary factor in resolving ambiguities in text (MacDonald, 1993). The student's task is more difficult if his attention is divided between employing math problem-solving strategies and coping with difficult vocabulary and unfamiliar content (Gathercole & Baddeley, 1993). On a test with math items of equivalent mathematical difficulty, eighth-grade students scored higher on the versions of items with vocabulary that was more frequent and familiar; the difference in score was particularly notable for students in low-level math classes (Abedi, Lord, & Plummer, 1995).

Word length. Readability formulas also use word length to compute level of difficulty (Bormuth, 1966; Flesch, 1948; Klare, 1974). As frequency of occurrence decreases, words tend to be longer. Accordingly, word length can serve as an index of word familiarity (Zipf, 1949; Kucera & Francis, 1967). Additionally, longer words are more likely to be morphologically complex, so word length also serves as a convenient index for morphological complexity—that is, the number of meaningful units packaged together in a single word. In one study, language minority students performed better on math test items with shorter word lengths than on items with longer word lengths (Abedi, Lord, & Plummer, 1995).

Sentence length. Sentence length has been identified as an index of difficulty and is used in readability formulas (Bormuth, 1966; Dale & Chall, 1948; Flesch, 1948; Klare, 1974). Sentence length serves as an index for syntactic complexity and can be used to predict comprehension difficulty; linguistic definitions of complexity based on the concept of word depth correlate with sentence length (Bormuth, 1966; MacGinitie & Tretiak, 1971; Wang, 1970; Yngve, 1960). The impact of shorter sentence length was also demonstrated with language minority students on math test items (Abedi, Lord, & Plummer, 1995).

Length of item. Students appear to find longer problem statements more difficult. A study of algebra word problems found a correlation between the number of words in the problems and problem-solving time (Lepik, 1990). Another study found a significant correlation between length of prompt and number of correct responses (Jerman & Rees, 1972).

Passive voice constructions. People find passive verb constructions more difficult to process than active constructions (Forster & Olbrei, 1973) and more difficult to remember (Savin & Perchonock, 1965; Slobin, 1968). Passive constructions occur less frequently than active constructions in English (Biber, 1988). Children learning English as a first language have more difficulty understanding passive verb forms than active verb forms (Bever, 1970; de Villiers & de Villiers, 1973).

Furthermore, passive constructions can pose a particular challenge for non-native speakers of English; passives in most languages are used much less frequently than in English, and in more restricted contexts (Celce-Murcia & Larsen-Freeman, 1983). Also, passives tend to be used much less frequently in conversation than in certain types of formal writing, such as scientific writing (Celce-Murcia & Larsen-Freeman, 1983). For these reasons, non-native speakers may not have had much exposure to the passive voice and may not be able to process passive sentences as easily as active sentences. Adolescent native speakers, as well, may have difficulties with the passive voice because of lack of exposure to this structure. In one study, eighth-grade students (native and non-native English speakers) were given equivalent math items with and without passive voice constructions; students in average math classes scored higher in the versions without passive constructions (Abedi, Lord, & Plummer, 1995).

Long noun phrases. Noun phrases with several modifiers have been identified as potential sources of difficulty in math items (Spanos et al., 1988). Long nominal compounds typically contain more semantic elements and are inherently syntactically ambiguous; accordingly, a reader's comprehension of a text may be impaired or delayed by problems in interpreting them (Halliday & Martin, 1994; Just & Carpenter, 1980; King & Just, 1991; MacDonald, 1993). Romance languages such as Spanish, French, Italian, and Portuguese make less use of compounding than English does, and when they do employ the device, the rules are different; consequently, students whose first language is a Romance language may have difficulty interpreting compound nominals in English (Celce-Murcia & Larsen-Freeman, 1983).

Long question phrases. Longer question phrases occur with lower frequency than short question phrases, and low-frequency expressions are in general harder to read and understand (Adams, 1990).

Comparative structures. Comparative constructions have been identified as potential sources of difficulty for non-native speakers (Jones, 1982; Spanos et al., 1988) and for speakers of non-mainstream dialects (Orr, 1987; Baugh, 1988).

Prepositional phrases. Students may find interpretation of prepositions difficult (Orr, 1987; Spanos et al., 1988). Languages such as English and Spanish may differ in the ways that motion concepts are encoded using verbs and prepositions (Slobin, 1996).

Sentence and discourse structure. Two sentences may have the same number of words, but one may be more difficult than the other because of the syntactic structure or discourse relationships among sentences (Finegan, 1978; Freeman, 1978; Larsen, Parker, & Trenholme, 1978).

Clause types. Subordinate clauses may contribute more to complexity than coordinate clauses (Botel & Granowsky, 1974; Hunt, 1965, 1977; Wang, 1970).

Conditional clauses. Conditional clauses and initial adverbial clauses have been identified as contributing to difficulty (Spanos et al., 1988; Shuard & Rothery, 1984). The semantics of the various types of conditional clauses in English are subtle and hard to understand even for native speakers (Celce-Murcia & Larsen-Freeman, 1983). Non-native speakers may omit function words (such as *if*) and may employ separate clauses without function words (Klein, 1986). Separate sentences, rather than subordinate *if* clauses, may be easier for some students to understand (Spanos et al., 1988). Statistically, languages of the world prefer conditional clauses in iconic order—that is, preceding main clauses rather than following them. In fact, some languages do not allow sentences with the conditional clause in last position (Haiman, 1985). Consequently, sentences with the conditional clause last may cause difficulty for some non-native speakers.

Relative clauses. Since relative clauses are less frequent in spoken English than in written English, some students may have had limited exposure to them (in fact, Pawley and Syder, 1983, argue that the relative clauses in literature differ from those in spoken vernacular language). They are acquired relatively late by first-language learners. Languages differ with respect to marking structures and word ordering for relative clauses (Schachter, 1983), so they may be difficult for a non-native speaker to interpret if his or her first language employs patterns that are different from those of English.

Concrete vs. abstract or impersonal presentations. Studies show better performance when problem statements are presented in concrete rather than abstract terms (Cummins et al., 1988). Information presented in narrative structures tends to be understood and remembered better than information presented in expository text (Lemke, 1986).

From the studies discussed above, we identified features of ordinary English that may contribute to the overall difficulty of a mathematics problem statement. Then we surveyed NAEP math items to identify which of those features were present in the items and could be modified without changing the math content of the items. We included the features in a rubric for rating the complexity of a problem statement, and we were guided by them in making modifications to existing math items.

Differential Influences on Mathematics Test Performance

The performance of certain subgroups of students may be particularly affected by background factors and the linguistic complexity of the text. One study found that the language of the items influenced the performance of low-achieving eighth graders (Larsen, Parker, & Trenholme, 1978). Researchers devised three tests of equal mathematical difficulty but with clause structures at three levels of complexity—high, moderate, and low. The low-achieving subgroup of students scored significantly lower on the version of the test that was more complex linguistically.

In an earlier CSE/CRESST study, researchers developed two versions of a test comprised of 1990 and 1992 NAEP math items for eighth-grade students (Abedi, Lord, & Plummer, 1995). Tests were administered to students in math classes in southern California. The data suggested that, for some groups of students, performance was better on the test version with several linguistic features simplified. Additionally, the largest difference in scores was found for students in low- and average-level math classes. These findings informed the current study.

Purpose

The purpose of this study is to investigate various language background and linguistic factors and examine their effect on the math performance of language minority and language majority students. Research questions include:

- Is NAEP math performance of students with limited English proficiency affected by student background variables?

- Are there differences in NAEP math performance among different groups of LEP and non-LEP students?[2]

- Do linguistic modifications have a greater impact on the performance of students from certain backgrounds? If so, what modifications, with which groups of students, and under what conditions?

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[2] In this study, "non-LEP students" refers to two groups: (a) LEP students who transitioned to Fluent English Proficient (FEP) status, based on demonstrated proficiency in English; and (b) native speakers of English, designated as Initially Fluent in English (IFE). Classification is based on student background information obtained from participating schools.

- What impact do English reading ability, language of instruction, and other background variables have on NAEP math performance?

Research Hypotheses

Several hypotheses address the main research questions in this study. In each set, the hypotheses are stated in the null and alternative forms:

Factor A (Test Booklets)

H_{0A}: There are no significant differences on NAEP math test performance between students on the three linguistically different booklets.

H_{1A}: Among LEP students, scores on the modified English booklet will be highest, scores on the original English booklet will be lowest, and scores on the Spanish booklet will fall between the scores for the other two booklets.

Factor B (LEP Status)

H_{0B}: There is no significant difference on NAEP math test performance between students designated as limited English proficienct (LEP) and students designated as non-LEP (FEP/IFE).

$H_{1B:}$ Students designated as LEP will perform significantly lower on the NAEP math test than students designated as non-LEP (FEP/IFE).

Interaction Between Factor A (Test Booklets) and Factor B (LEP Status)

H_{0AB}: There are no significant differences on NAEP math performance between LEP and non-LEP students who are administered different test booklets.

H_{1AB}: Students' math performance on the different test booklets differs for both LEP and non-LEP students

Method

Participants

Data were collected from 1394 eighth-grade students (ages 13 to 14 years) during August and September 1996. Students were selected from a larger, nonprobability sample of 49 math classrooms in nine middle schools from two major school districts (Los Angeles Unified School District and Long Beach

Unified School District) in southern California. The math classes varied in content and difficulty (e.g., eighth-grade basic math, pre-algebra, algebra), and in the language of instruction (English only, English sheltered, Spanish only), with several classes taught by the same teachers. Efforts were made to target and select schools with large Spanish-speaking student enrollments, sizable English language learner populations, and varying socioeconomic, language, and ethnic backgrounds. Additionally, students varied in country of origin, English language and math proficiency, number of years in LEP programs, and number of years in the United States. Class lists were provided by participating schools to provide insights into how students were categorized by native language, LEP student designation or program (if available), LEP entry date (if available), and date transitioned into Fluent English Proficient (FEP) designation (if applicable).

Design

One of three test booklets was administered randomly to eighth-grade students in intact math classrooms. Randomization was conducted to minimize the class, teacher and school effects. Each test booklet contained the same NAEP math test items (differing only by linguistic demands), a reading proficiency test, and a student background questionnaire (see Table 1).

Table 1

Test Booklets Administered in the Study

		Test Booklet		
	No. of items	Modified English (A)	Original English (B)	Original Spanish (C)
NAEP 8th-grade math test	35	Complexity reduced (English)	Linguistically complex (English)	Linguistically complex (Spanish)
NAEP 8th-grade reading test	11	Original (English)	Original (English)	Original (English)
Language bkgrd. questionnaire	45	Original (English)	Original (English)	Original (Spanish)
% of sample		43%	40%	17%

Secured math test items for this study were derived from alternate versions of the 1996 NAEP Grade 8 Bilingual Mathematics booklet (M921CG, M9CP, M10CG) with some items common to all the test versions. Math questions were presented in both the English and Spanish languages, whereby students participating in the national assessment could select whichever language they preferred. From this pool of math items, three test booklets for the current study were developed. All booklets contained the same math items, differing only in their linguistic demands. The "Original English" test booklet contained English language math items (taken directly from NAEP test booklet). The "Modified English" test booklet contained a linguistically modified (with simplified or clarified English language) version of the math items, based on the CRESST modification rubric (discussed below). The "Spanish Original" test booklet contained the Spanish language math items (taken directly from NAEP test booklet). During the linguistic modification process, only linguistic structures and nontechnical vocabulary were modified. Mathematics vocabulary and math content were retained. Contextual data (e.g., aggregate English language and math proficiency for students in the classroom) were also collected for each class, through a questionnaire completed by the teachers.

Instruments

Several instruments were developed or modified for the study:

NAEP mathematics test. The NAEP math assessment is designed to target mathematics knowledge that eighth-grade students might encounter in everyday, "real-life" situations. Thirty-five items were selected from 37 total secured items (two items which required use of calculators were omitted) in the 1996 NAEP Grade 8 Bilingual Mathematics booklet (M921CG, M9CP, M10CG). The items represented a broad range of mathematical tasks and content knowledge (e.g., addition, subtraction, multiplication, division, calculating rate/time/distance, fractions, proportions, measurement and weights, geometry, pre-algebra, algebra, and reading graphs and tables). Students received 45 minutes to complete the math test.[3] No calculators, dictionaries, or other study materials were permitted during the test. Three test versions were prepared:

- *Original English language*–English language test items from 1996 NAEP Grade 8 Bilingual Mathematics booklet;

[3] The 45-minute time limit was established based on results from a pilot study with a comparable sample of students. This is the time period required for 75% of the students to complete the math test.

- *Modified English language*–Linguistically modified versions of original English items, rewritten by linguistic and math content experts at CRESST (for linguistic modification procedures, see Procedures section); and

- *Original Spanish language*–Spanish language test items from 1996 NAEP Grade 8 Bilingual Mathematics booklet.

Test booklets contained the same math items, in the same order, with 24 selected response (multiple-choice) and 11 constructed response (performance-based) items. Selected-response test items were scored using the NAEP answer key; constructed-response items were scored using the NAEP scoring rubric. Each item was scored by up to three raters (two Spanish/English bilingual Latinas, one Caucasian female) following a training session. Initial training encouraged raters to score the substantive content of the responses only (not writing, grammar, spelling, or punctuation) to the extent possible. After responses for the first 100 students were rated, interrater reliabilities were calculated. Raters were given additional training for items with low reliability statistics (e.g., kappa, percent exact agreement). Overall, efforts were made to ensure that scores were given depending on the mathematical accuracy and detail of each response, not on the accuracy of the English language, although language may have indirectly impacted the raters' scores.

Preliminary interrater reliability analyses using the Interrater/Test Reliability System (Abedi, 1994) with an initial group of 200 student responses showed high interrater consistency for most test items (reliabilities ranging from .90 to .95). For a few items, lower interrater reliabilities were obtained (ranging from .50 to .65). Table 2 presents a summary of the interrater reliability analyses. Because of the high interrater reliability, the remaining open-ended questions were rated by two raters. Further, responses written in Spanish were rated by only the bilingual raters.

NAEP reading test. Students read a two-page story, then responded to 11 questions (7 selected response, 4 constructed response). The passage and items were a secured 1992 Grade 8 Reading assessment (Block O12R5). Questions required skim and scan techniques, description or inferences about specific characters, or drawing metaphorical interpretations from events in the story. Responses were scored according to the NAEP answer key and the scoring rubric.

Students were given 25 minutes to complete the reading test, as in the original NAEP testing procedures.

Similar scoring and training procedures were provided for rating both the reading and math items. As with the math test, interrater reliabilities were obtained for the first 200 student responses. Interrater reliabilities for the reading test items were generally lower (ranging from .75 to .85) than for the math test items, with one item posing considerable difficulty for the raters (interrater reliability ranging from .51 to .65). See Table 2 for reliability summaries for the reading test.

Table 2

Results of Interrater Reliability Studies for a Sample of Math and Reading Test Items

Item #	Rater combs.	# Students	Kappa	% Agreement
Math 2	1,2,3	93	.94	96.77
	1,2	93	.92	96.77
	2,3	95	.92	95.84
	1,3	126	.92	96.83
Math 5	1,2,3	60	.67	85.00
	1,2	61	.73	91.80
	2,3	60	.71	91.67
	1,3	85	.57	87.06
Math 6	1,2,3	94	.84	95.74
	1,2	97	.88	97.94
	2,3	95	.87	97.89
	1,3	152	.72	96.05
Math 9	1,2,3	70	.59	62.86
	1,2	75	.54	70.67
	2,3	71	.54	69.01
	1,3	118	.73	83.90
Math 29	1,2,3	42	.62	72.09
	1,2	45	.48	73.33
	2,3	42	.55	78.57
	1,3	58	.89	94.83
Math 34	1,2,3	15	.71	86.67
	1,2	15	.56	80.00
	2,3	16	.72	87.50
	1,3	23	.81	91.30
Math 35	1,2,3	13	.86	84.62
	1,2	13	.89	92.31
	2,3	16	.83	87.50
	1,3	19	.86	89.47
Reading 1	1,2,3	100	.60	73.00
	1,2	101	.72	88.12
	2,3	102	.53	78.43
	1,3	144	.62	82.64
Reading 4	1,2,3	86	.65	77.91
	1,2	87	.59	82.76
	2,3	88	.74	88.64
	1,3	123	.62	86.18
Reading 7	1,2,3	81	.39	50.62
	1,2	81	.35	65.43
	2,3	82	.42	64.63
	1,3	105	.35	63.81
Reading 11	1,2,3	81	.69	76.83
	1,2	84	.56	78.57
	2,3	81	.75	88.89
	1,3	102	.68	83.33

Rater 1–Bilingual Latina; Rater 2–Caucasian, English-speaking female; Rater 3–Bilingual Latina.

Student background questionnaire. Each student was administered a 45-item questionnaire, comprised primarily of items from the 1996 NAEP Grade 8 Bilingual Mathematics booklet, relating to students' attitudes toward mathematics, grades in mathematics, self-reports of ability to understand math terminology and in performing computations, and educational and mathematical ambitions. This questionnaire contained additional questions from an earlier language background study (Abedi, Lord, & Plummer, 1995). Questionnaire development was also informed by other NAEP background questionnaires and the 1988 National Education Longitudinal Study (NELS). Students were given approximately 15 minutes to complete the questionnaire.[4] (See Appendix A for sample.)

Teacher classroom questionnaire. Teachers were asked to estimate aggregate percentage breakdowns of various classroom and student characteristics, including percent LEP and FEP/IFE students in classroom at time of testing, ethnic breakdown and native language of students, and percent that received free- or reduced-price lunches. Teachers also estimated the students' math levels (percentage in low-level math, medium-level math, high-level math), and English language levels (reading, writing, and oral proficiency). (See Appendix A for sample.)

Procedure

For this study, NAEP test administration was conducted by six independent, trained CSE/CRESST test administrators, all of whom were retired educators (e.g., LAUSD assistant superintendents, principals, resource teachers). The test administrators varied by ethnic background, although none were Latino (three Caucasian, two African-American, one Asian). Four were female, two were male. Test administrators attended a half-day training session and were accompanied by the project coordinator for their first testing assignment for observation. Testing sites were also monitored in random visits by project staff. Schools received honoraria of $75 per participating classroom, and each student received a UCLA pencil.

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[4] As with the math test, the 15-minute time limit for the questionnaire was established based on results from a pilot study with a comparable sample of students. This is the time period required for 75% of the students to complete the background questionnaire.

In each classroom, the test administrators randomly distributed the test booklets to the students. LEP students were given one of the three test booklets (English Original, English Modified, Spanish Original), while non-LEP (FEP and IFE) students were randomly administered one of the two booklets in English (English Original or English Modified).

Linguistic Modification of Math Items

Previous research on the effect of linguistic complexity on the performance of LEP students in content-area assessments was reviewed, and language features with potential impact on student performance were identified. These features included word frequency, word length, sentence length, length of item, passive voice constructions, long noun phrases, long question phrases, comparative structures, prepositional phrases, sentence and discourse structure, clause types, conditional clauses, relative clauses, and concrete versus abstract or impersonal presentations. This list of linguistic features was reviewed by three experts in linguistics and/or the teaching of English. Their comments and suggestions were incorporated.

Next, the NAEP math items were analyzed to determine which of these linguistic features were present in the items. The language of many of the NAEP math items presented potentially challenging linguistic structures in the areas identified.

Each math item with potentially difficult language was then rewritten, with the goal of making the nontechnical language more readily understandable. Potentially difficult linguistic features were removed, reduced, or recast. Changes were made with respect to those features identified in earlier research (see Literature Review) as potential sources of difficulty. Complex syntactic structures were removed or modified. Mathematical vocabulary and concepts were preserved; only nontechnical vocabulary was changed. For illustrative purposes, an original item (from NAEP released items used in Abedi, Lord, & Plummer, 1995) and the modified version are presented below; the changes are specified.

Original:

If $\square$ represents the number of newspapers that Lee delivers each day, which of the following represents the total number of newspapers that Lee delivers in 5 days?

A) $5 + \square$

B) $5 \times \square$

C) $\square + 5$

D) $(\square + \square) \times 5$

Modified:

Lee delivers $\square$ newspapers each day. How many newspapers does he deliver in 5 days?

Changes:

- Conditional clause changed to separate sentence
- Two relative clauses removed and recast
- Long nominals shortened
- Question phrase changed from "which of the following represents" to "how many"
- Item length changed from 26 to 13 words
- Average sentence length changed from 26 to 6.5 words
- Number of clauses changed from 4 to 2
- Average number of clauses per sentence changed from 4 to 1

The modified items were compared with the original items by a mathematics education expert to ensure that, in each item, the modifications did not change the mathematical concepts or the problem to be solved. The reviewer's comments and suggestions were incorporated.

Linguistic Complexity Variables

In order to identify which modifications contributed to higher student performance, a set of complexity variables was identified. This set was limited to those linguistics features present in the original 35 NAEP items; selection was guided by the list of features discussed in the literature, as summarized above. The complexity variables included linguistic features considered to be potential causes of difficulty, as well as indexes reflecting underlying causes of difficulty. The complexity variables included the following:

1. Length: number of words in item
2. Length: number of characters in item
3. Maximum word length in item
4. Length: number of sentences in item
5. Length of nominals
6. Passive voice constructions
7. Modal verbs
8. Relative clauses
9. Adverbial clauses and phrases
10. Conditional clauses
11. Complement clauses
12. Question phrases
13. Concept relevance
14. Familiarity/frequency of nonmathematical, nonscientific vocabulary

A procedure was devised for specifying a quantitative value for each linguistic complexity variable for each item (see Appendix B). From the initial 14 potential linguistic complexity variables for math items, an additional 16 composite variables were created. These variables were divided into four groups based on the method of determining numerical values for item ratings. Ratings for the first group (Group A) were obtainable computationally with routine wordprocessing utilities or fairly straightforward computer programs. Ratings for the second group of indexes (Group B) were assigned by experts in English grammar. Ratings for the third group (Group C) were assigned by raters with a sophisticated linguistic perspective as well as familiarity with the vocabulary of southern California eighth graders. The fourth group of variables (Group D) was calculated by combining ratings on variables from Groups A, B, and C.

Each original and modified math item was assigned a numerical value for each linguistically complexity variable. Ratings for Group A were computed. Ratings for Groups B and C were assigned by two raters; rater disagreements typically were resolved by clarifying definitions and criteria. Ratings for Group D were calculated by combining ratings on other variables.

Categorization of LEP and non-LEP students

Categorization of students into various student designations (LEP, FEP, IFE) was obtained from the participating schools. Designations were based primarily on students' performance on English language proficiency tests administered at the schools upon entrance into the educational program and updated periodically. It appears, however, that different schools do not necessarily use the same designation criteria and also may have varying types of instructional programs (e.g., Accelerated Bilingual, English Language Development Program Literate). This suggests that students designated as limited English proficient (LEP) at one school would not necessarily be designated as LEP at another school, even within the same school district. Additionally, distinctions between LEP levels are often programmatic, based on additional factors tangential to English proficiency levels.

For purposes of this study, students were categorized into LEP or non-LEP (FEP/IFE) groups according to various criteria: (a) schools' specifications, (b) NAEP definition. Proxies for LEP and non-LEP status (English dominant, Other language dominant) were also created by using information obtained from the background questionnaire. We recognize that some of these categorizations may not clearly indicate LEP or non-LEP status, both in this study and in general; thus, the data should be interpreted accordingly.

Schools' specifications. Schools in our sample represented two large school districts in southern California. The districts classified students for whom English is a second language differently, but may have designated students according to LEP levels (up to 11 different LEP programs), Fluent English Proficient (FEP), or Initially Fluent in English (IFE). Based on this categorization, 62% (n = 876) students were classified LEP, while the remaining 38% (n = 518) were classified as FEP or IFE.

NAEP definition. NAEP has recently changed its inclusion guidelines. Prior to 1995, the procedures were based on criteria for "excluding" students. However, the guidelines presented in the 1995 NAEP field test were revised to aid in making "appropriate and consistent decisions about the inclusion of . . . LEP students" (Olson & Goldstein, 1997). Students with limited English proficiency (LEP) are now to be included in NAEP assessments if:

- Student has received academic instruction primarily in English for at least three years; or

- Student has received academic instruction in English for less than three years, if school staff determine that the student is capable of participating in the assessment in English; or

- Student, whose native language is Spanish, has received academic instruction in English for less than three years, if school staff determine that the student is capable of participating in the assessment in Spanish (if available).

Students' background variables. The following questions from the background questionnaire were used for categorizing students based on language-related variables:

- "What country do you come from?" Nearly half the students responded "U.S." (49%, n = 685), while the remaining students cited other countries (51%, n = 709).

- "Do you speak another language besides English?" More than three-quarters of the students responded "Yes" (79%, n = 1055), while the remaining students responded "No" (21%, n = 280).

- "If you don't understand how to do some homework, and you need to ask a friend how to do it, do you prefer to do that in: English or your other language?" Most students responded "English" (78%, n = 823), while the remaining students selected "other language" (22%, n = 239).

- "In the last two years, how many times have you changed schools because you changed where you live?" Students responded as follows: none (68%); one (17%); two (8%); three or more (7%).

Findings

This section presents the initial descriptive findings from the student background questionnaire, overall performance levels of the students on the math and reading proficiency tests, and results as related to the research questions posed at the beginning of the report. These findings focus on eighth-grade students, with about three-quarters of the sample reporting themselves as Hispanic and/or Spanish speaking (76%). Percentage breakdowns for the questions and test performance, differentiating between the total sample of students and the Hispanic subsample are found in Appendix C.

Sample Descriptives

For the total eighth-grade sample, nearly two-thirds (62%) were classified by their respective schools as Limited English Proficient (LEP), 7% had transitioned into Fluent English Proficient (FEP) programs, and the remaining 31% were Initially Fluent in English (IFE). The mean number of years in the United States was 10.03, ranging from less than one year (2%) to 14 years or more (10%). There were slightly more males (54%) than females (46%). Students reported being enrolled in eighth-grade mathematics (49%), pre-algebra (23%), algebra (20%), or some other type of math class (e.g., integrated-sequential math, applied math). The distribution of test booklets in this study sample was 43% English Modified, 40% English Original, and 17% Spanish Original.

The student sample was generally very ethnically and culturally diverse, with students or their families originating in all parts of the world. More than half (53%) were born in the United States, or had grown up completely in the United States, with the remaining hailing from Mexico (28%), some other Latin American country (6%; e.g., Guatemala, El Salvador, Honduras), Cambodia (3%), Thailand (3%), another Asian or southeast Asian country (4%; Philippines, Vietnam, Laos). The remaining students (3%) reported being from a variety of European (e.g., England, Germany), Middle Eastern (e.g., Iran, Syria), and other countries.

Most students in the sample were partially proficient in at least two languages, with 79% speaking another language besides English, and 21% speaking English only. Of those who reported speaking a second language, 76% spoke Spanish, 8% Cambodian, 4% Khmer, 2% Vietnamese, and the remaining 10% scattered across several other languages (e.g., Tagalog, Hmong, Lao, French, Thai, Armenian, Farsi). Most students spoke their home language with their parents (82%), their siblings (83%), other children at school (81%), or people outside of school (81%). More than half reported speaking their home language with their parents always or most of the time (53%), and less so with siblings (33%), at school (27%), and outside of school (27%).

Students were generally confident about their home language abilities. Nearly half (49%) reported that they understood their home language very well, but fewer spoke or wrote the language at the same level (43% and 40%, respectively). About 39% reported reading their home language very well. In fact, when given homework that they did not understand, three-quarters (78%) of the students preferred to discuss the homework in English rather than in their home language (22%).

The students were also generally confident about their English language abilities. Nearly half reported that they understood spoken English very well (49%), spoke English well (46%), read English well (42%), and wrote English well (39%). About half had home environments that housed English language reading materials, such as at least 25 books (65%), encyclopedias (51%), and magazines (52%) written in English. Fewer students reported receiving an English language newspaper regularly in their home (36%).

Students reported spending more time watching television than reading books or doing homework. The mean number of hours watching television was 3.4 hours per day, with one-quarter of the sample (29%) watching for 5 or more hours per day. In contrast, more than half of the sample (56%) spent one hour or less per week reading for fun, and only 10% did so for at least 5 or more hours per week. Most of the student sample (86%) spent one hour or less per day on homework.

Academic performance and ambitions among the students varied widely. Since the sixth grade, more than half reported having a "B" grade point average or better in math (59%), and in English (66%). Nearly the entire subsample (90% and 92%, respectively) reported average grades of "C" or better in both math and English. Approximately one-quarter of the students (23%) did not know how far they would go in school. Of those who offered a prediction, 2% did not think they would finish high school, 12% would graduate high school, 10% would have some education after high school, 44% hoped to graduate from college, and 8% would pursue graduate school.

The students reported what type of mathematics class they were enrolled in at the time of testing, although their responses sometimes differed from those of their teachers'. For example, nearly half of the students (49%) reported being in eighth-grade math classes, 23% reported they were in pre-algebra, 20% in algebra, and 8% in some other type of math class (e.g., integrated-sequential math, applied math). In contrast, the teachers reported their students' enrollment primarily in eighth-grade math classes (68%), pre-algebra (21%), and algebra (11%).

Data on students' attitudes toward mathematics were also collected. In general, the students were positive about their math experiences. More than half (54%) agreed or strongly agreed with the statement, "I am good at mathematics." More than two-thirds reported understanding much of what was going on in math classes (69%), found math useful for solving problems (78%), and thought everyone could do well in math if they tried (87%). Even more students thought they were good or very good at reading English (74%) than at doing math (52%), in response to the question, "How good at math/reading English do you think you are?" Two background questions referred to the same idea (how good are you at math?), with slightly different wordings. Frequency distributions suggest that students answered similarly to these questions.

Results of Overall Math Performance

This section presents initial analyses for the entire sample of 1394 eighth-grade students. Mean scores under different conditions of LEP status (LEP, FEP/IFE) and type of test booklet (English Modified, English Original, Spanish Original) are presented. The mean NAEP math achievement test score for the sample was 12.71 (SD = 6.46, n = 1394) out of 35 points possible (see Table 3).

Table 3

Mean NAEP Math Achievement Scores for Eighth-Grade Students (35 Points Possible)

	LEP status		
Math book	LEP (B1)	FEP/IFE (B2)	Column total
English Modified (A1)	11.79 (SD = 5.67; n = 345)	16.71 (SD = 7.48; n = 248)	13.84 (SD = 6.92; n = 593)
English Original (A2)	11.84 (SD = 5.50; n = 353)	15.26 (SD = 7.05; n = 206)	13.10 (SD = 6.33; n = 559)
Spanish Original (A3)	9.16 (SD = 3.63; n = 225)	7.41 (SD = 3.86; n = 17)*	9.04 (SD = 3.67; n = 242)
Row total	11.17 (SD = 5.30; n = 923)	15.74 (SD = 7.40; n = 471)	12.71 (SD = 6.46; n = 1394)

* A small number of non-LEP students were inadvertently given a Spanish language math test booklet. We recognize that inclusion of students in this cell (n = 17) may be problematic due to unequal Ns. However, we have chosen to include them in subsequent analyses as the cell is necessary for 2x3 ANOVA analyses.

In general, students scored highest on the linguistically modified math test items (M = 13.84, SD = 6.92, n = 593), followed by the same math items in original English (M = 13.10, SD = 6.33, n = 559), and lowest on the math items in Spanish (M = 9.04, SD = 3.67, n = 242). Additionally, non-LEP (FEP, IFE) students (M = 15.74, SD = 7.40, n = 471) performed better on the math test than LEP students (M = 11.17, SD = 5.30, n = 923), both in general and across test booklets.

A two-factor analysis of variance design was used to examine the impact of linguistic modification on students' performance in math (see research hypotheses stated above). The data suggest significant differences ($p < .01$, unless otherwise stated) in math performance by LEP status and test booklet, and a significant interaction effect between the two factors (see Table 4).

For the first factor (Math booklet), a significant main effect was obtained ($F = 28.82$; df = 2,1388; $p = 0.00$). The largest difference was found between math items in standard Spanish language (M = 9.04, SD = 3.67, n = 242) and those in modified English (M = 13.84, SD = 6.92, n = 593) and standard (original) English (M = 13.10, SD = 6.33, n = 559). Similarly, for the second factor (LEP status), a significant main effect ($F = 15.86$; df = 1,1388; $p = 0.00$) indicated that the performance of the eighth-grade students in this study was different between students designated as LEP and those not (FEP, IFE).

In addition, there was a significant interaction (F = 9.72, df = 2, 1388, p = 0.00) between the type of math booklet (Factor A) and students' LEP status (Factor B). These findings have numerous implications. For students designated as LEP, math performance was significantly higher (about 2.6 points higher, on average) for students administered the NAEP items in English (modified English or

Table 4

ANOVA Results for Math Scores by Math Book and LEP Status

Source of variation	Sum of squares	df	Mean squares	F-ratio	Significant contrasts
Math book (A)	2030.83	2	1015.41	28.82**	A1,A3** A2,A3**
LEP status (B)	558.63	1	558.63	15.86**	B1,B2**
Interaction effects (AxB)	684.99	2	342.50	9.72**	
LEP students (B1)					A1,A3** A2,A3**
FEP/IFE students (B2)					A1,A2** A1,A3**
English mod. book (A1)					B1,B2**
English orig. book (A2)					B1,B2**
Within subjects	48895.00	1388	35.23		
Total	58078.80	1393	41.69		

*sig. p<.05; **sig. p<.01.

standard English language), compared with the same items in standard Spanish. One explanation is that nearly all students in the sample received math instruction in English (Sheltered English, English only)—suggesting that LEP students perform best on math tests where the language of the items matched their language of instruction.

This hypothesis was validated in additional subanalyses with LEP students enrolled in math classes where instruction was in Spanish (M = 7.98, SD = 3.58, n = 80). For these students, performance was significantly higher on the math test in Spanish (M = 8.74, SD = 3.40, n = 62), than the test in standard English (M = 3.60, SD = 3.26, n = 11) or modified English (M = 5.29, SD = 2.56, n = 7). Though the numbers of students in this subsample are small, these findings suggest that language of instruction is an important consideration in identifying suitable test accommodations for LEP students.

Despite the students' overall higher performance on the modified English language math tests, preliminary analyses suggest that linguistic modification of math test items did not necessarily lead to higher performance for LEP students. No significant difference was found between LEP students' performance on the English Modified items ($M = 11.79$, $SD = 5.67$, $n = 345$) and the English Original items ($M = 11.84$, $SD = 5.50$, $n = 353$). The slightly higher score on original English language items is likely due to chance. Instead, linguistic modification may have had greater impact for non-LEP students. Non-LEP students (classified as FEP or IFE by schools), all receiving math instruction in English, performed significantly higher on the modified English test items ($M = 16.71$, $SD = 7.48$, $n = 248$) than on the standard English test items ($M = 15.26$, $SD = 7.05$, $n = 206$). This suggests that linguistic clarification of math items may be beneficial to all students.

Other important interactions are noted. For students administered the math items in modified English or standard English, non-LEP (FEP, IFE) students consistently performed higher than LEP students. For example, for students who were administered the items in modified English, FEP/IFE students scored significantly higher ($M = 16.71$, $SD = 7.48$, $n = 248$) than LEP students ($M = 11.79$, $SD = 5.67$, $n = 345$). Additionally, for students with the same items in standard English, FEP/IFE students ($M = 15.26$, $SD = 7.05$, $n = 206$) scored significantly higher than LEP students ($M = 11.84$, $SD = 5.50$, $n = 353$).

Results of Overall Reading Performance

The reading test, from the NAEP Grade 8 reading assessment, was administered to obtain a measure of the students' reading proficiency. Because of time constraints in the testing environment, a single section was selected with one reading passage and 11 responses. The resulting measure was considered limited but potentially valuable, and nevertheless preferable to the option of omitting a reading measure entirely. In addition to students' reading proficiency, narrowly defined, the scope of the test included language arts (e.g., metaphor and inferences about characters were included). Accordingly, the reading test scores may have reflected language arts capabilities broader than those assumed to be required for math problem scenario comprehension. Summary findings are presented (see Table 5).

Table 5

Mean NAEP Reading Achievement Scores for 8th-Grade Students (11 Points Possible)

	LEP Status		
Math book*	LEP (B1)	FEP/IFE (B2)	Column total
English modified (A1)	4.22 (SD = 2.84; n = 345)	5.84 (SD = 3.06; n = 248)	4.89 (SD = 3.04; n = 593)
English original (A2)	4.22 (SD = 2.91; n = 353)	6.10 (SD = 2.93; n = 206)	4.91 (SD = 3.05; n = 559)
Spanish original (A3)	2.76 (SD = 2.43; n = 225)	2.65 (SD = 2.55; n = 17)	2.75 (SD = 2.43; n = 242)
Row total	3.86 (SD = 2.84; n = 923)	5.84 (SD = 3.04; n = 471)	4.53 (SD = 3.06; n = 1394)

*A small number of non-LEP students were inadvertently given a Spanish language math test booklet. We recognize that inclusion of students in this cell (n = 17) may be problematic due to unequal Ns. However, we have chosen to include them in subsequent analyses as the cell is necessary for 2x3 ANOVA analyses.

Overall, the mean reading test scores were fairly low (M = 4.53, SD = 3.06, n = 1394). As the reading test was the same for all students, regardless of test booklet, we would expect the scores to be comparable across test booklet groups. However, the score means suggest that students receiving the “Spanish Original” test booklet scored lower than students receiving either of the English language test booklets.

We speculate that this difference is not the result of a non-randomized sampling design, but is to be expected based on the student samples who were administered the Spanish-only test booklets. In other words, students who were administered either of the English language test booklets (modified or standard English) comprised a wider variety of student groups, including native-English speakers. In contrast, students who were administered the Spanish language test booklet included only those reported as Hispanic and/or Spanish-speaking, including non-native English speakers and non-English speakers.

The most notable finding is the difference between the LEP and non-LEP students’ performance on the reading assessment. As expected, FEP/IFE students (M = 5.84, SD = 3.04, n = 471) consistently performed higher on the reading test than LEP students (M = 3.86, SD = 2.84, n = 923)—an approximate 2-point difference, which was statistically significant (F-ratio = 18.23, df = 1,1388; p = 0.00) (see Table 6).

Table 6

ANOVA Results for Reading Scores by Math Book and LEP Status

Source of variation	Sum of squares	df	Mean squares	F-ratio
Math book (A)	345.50	2	1015.41	28.82**
LEP status (B)	147.83	1	147.83	18.23**
Interaction effects	56.53	2	28.27	3.49*
Within subjects	11256.10	1388	8.11	
Total	13025.11	1393	9.35	

*sig. p<.05; **sig. p<.01.

This finding provides evidence that the reading achievement test, despite its limitations related to validity and worthiness as a measure of students' reading proficiency, emerged as a suitable predictor of math performance. FEP/IFE students scored higher on reading tests and math tests. Further, students with a better command of English text (FEP/IFE students) were likely more able to read and interpret the math items correctly than students with lower English proficiency levels (LEP students).

Impact of Reading Proficiency on Math Performance

A source of variation that was not controlled by random assignment was students' language background. Earlier findings (see Tables 4 and 6) indicated a significant difference between LEP and non-LEP students' performance in math and reading. One may expect a significant difference between LEP and non-LEP students in English reading comprehension, but a performance difference between LEP and non-LEP students in math is more difficult to explain.

One possible explanation is that low performance of LEP students in math may be due to linguistic factors. Thus, if students' level of proficiency in English is controlled, the differences between the performance of LEP and non-LEP students in math may diminish. To shed light on this issue and to answer the question of the degree of impact of students' language proficiency on math performance, scores on the reading comprehension test were used as a covariate in a simple two-factor analysis of covariance (ANCOVA) design (see Table 7).

Table 7

ANCOVA Results for Math Scores by Math Book and LEP Status, Using Reading Comprehension Score as a Covariate

Source of variation	Sum of squares	df	Mean squares	F-ratio	Significant contrasts
Math book (A)	888.54	2	444.27	15.49**	A1,A3** A2,A3**
LEP status (B)	159.26	1	159.26	5.55*	B1,B2*
Interaction effects (AxB)	481.09	2	240.54	8.38**	
LEP students (B1)					A1,A3** A2,A3**
FEP/IFE students (B2)					A1,A2** A1,A3** A2,A3**
English mod. book (A1)					B1,B2**
English orig. book (A2)					B1,B2**
Covariate (reading score)	9100.79	1	9100.79	317.20**	
Within subjects	39794.20	1387	28.69		
Total	58078.80	1393	41.69		

*sig. $p<.05$; **sig. $p<.01$.

Comparing the earlier ANOVA findings (Table 4) with the ANCOVA findings in Table 7 reveals the impact of students' reading proficiency on their math performance. After controlling for students' reading levels (as measured by NAEP reading test), there were still significant differences in students' math test scores, by type of test booklet (F-ratio = 15.49; df = 2,1387; p = .000) and by students' LEP status (F-ratio = 5.55; df = 1,1387; p = .019). However, when a measure of English reading proficiency enters into the analysis, the effects due to test book type and LEP status, as well as their interaction effect (F-ratio = 8.38; df = 2, 1387; p = .000), become less evident. These analyses suggest that students' reading level has a substantial impact on their performance in the mathematics content area.

It might be hypothesized that reading proficiency would have a greater impact on math performance. This study measured reading proficiency with a test that included items dealing with interpretation and metaphor; in future studies, it may be desirable to use a reading test that focuses more narrowly on understanding expository prose.

Teacher and School Effects

If there are large significant differences between students' performance at different schools or between students taught by different teachers, those factors must also be accounted for using other analytical techniques (e.g., hierarchical linear models). Although random assignment of booklets to students within classrooms largely controls the overall teacher and school effects, we were nonetheless interested in whether school and/or teacher characteristics affected students' math performance.

To test the hypothesis of no significant difference between students' performance at different schools taught by different teachers, simple one-factor ANOVAs were performed on the data, using teachers and schools as independent variables. Table 8 presents the results of the ANOVA with math test scores as a dependent variable and school (10 levels) as the independent variable. The average math score was 12.71 (SD = 6.46, n = 1394), with school means ranging from 7.39 to 20.74 (out of 35 points possible). Further, the students' math scores were significantly different across the 10 schools participating in this study, well beyond the nominal level of .01 (F-ratio = 70.58; df = 9,1393; p = .000).

Table 8

ANOVA Results for Math Scores by School

Source of variation	SS	df	MS	F	P
School	18269.73	9	2029.97	70.58	0.000
Within subjects	39804.34	1384	28.76		
Total	58074.07	1393	41.69		

Similar results were obtained for reading test scores when students were compared across schools (see Table 9). The average reading score was 4.53 (SD = 3.06, n = 1394), with school reading means ranging from 2.34 to 6.55 (out of 11 points possible). Additionally, the students differed significantly on the reading test by participating school (F-ratio = 21.55, df = 9,1384; p = .000).

Table 9

ANOVA Results for Reading Scores by School

Source of variation	SS	df	MS	F	P
School	1602.47	9	178.05	21.55	0.000
Within subjects	11434.82	1384	8.26		
Total	13037.29	1393	9.36		

Tables 10 and 11 summarize the results of a simple one-way ANOVA analyses for math and reading test scores by teachers. The average math scores ranged from 7.4 to 20.7, out of 35 total items. As Table 10 indicates, an F-ratio of 34.88 with 18 and 1238 degrees of freedom indicated that the teacher effect was significant well beyond the .01 nominal level.

Similar results were obtained for reading scores. The average reading test scores ranged from 2.3 to 6.5, out of 11 possible (see Table 11). The results of the analysis of variance showed significant differences between different groups of students taught by the different teachers (F = 18.92, df = 18,1238, p = 0.000).

Table 10

ANOVA Results for Math Scores by Teacher

Source of variation	SS	df	MS	F	P
Teacher	17846.93	18	991.50	34.88	0.000
Within subjects	35195.93	1238	28.43		
Total	53042.86	1256	42.23		

Table 11

ANOVA Results for Reading Scores by Teacher

Source of variation	SS	df	MS	F	P
Teacher	2537.24	18	140.98	18.92	0.000
Within subjects	9222.98	1238	7.45		
Total	11760.23	1256	9.36		

The significant differences between students' performance in math and reading across the teacher and school factors suggest that students within different ranges of performance were included in this study. However, as indicated earlier, these differences were controlled by random assignment of the three booklets within each classroom.

Analyses of the Background Questionnaire

The background questionnaire contained 45 self-report questions on students' background characteristics, including numerous language-related questions. Two sets of analyses were performed: first, analyses concerning the relationship among students' background variables (including students' language background); second, analyses examining the impact of students' background characteristics on their math and reading performance. The specific background questions are presented below (see Table 12). The following is a discussion of these analyses.

Table 12

Selected Background Variables by Question Number

Composite	#	Question
ENGDOM/	Q4	How often do you speak that language with your parents?
OTHLANG	Q5	How often do you speak that language with your brothers and sisters?
	Q6	How often do you speak that language with your friends at school?
	Q7	How often do you speak that language with your friends outside school?

(table continues)

Table 12 (continued)

Composite	#	Question
ENGDOM/	Q8	How well do you speak that language?
OTHLANG	Q9	How well do you understand that language?
	Q10	How well do you read that language?
	Q11	How well do you write that language?
ENGLWEL	Q13	How well do you understand spoken English?
	Q14	How well do you speak English?
	Q15	How well do you read English?
	Q16	How well do you write English?
READFAM	Q20	Does your family get an English language newspaper regularly?
	Q21	Is there an encyclopedia in English in your home?
	Q22	Are there more than 25 books in English in your home?
	Q23	Does your family get any English language magazines regularly?
SELFGPA	Q28*	Mark the statement that best describes your grades in math since sixth grade.
	Q29*	Mark the statement that best describes your grades in English since sixth grade.
	Q30*	Mark the statement that best describes your overall grades since sixth grade.
ATTMATH	Q35	I like mathematics.
	Q36	I am good at mathematics.
	Q37	I understand most of what goes on in mathematics class.
Individual variables	Q2	How long have you lived in the United States? (years)
	Q24	How much television do you usually watch in a day?
	Q25	Not counting reading that you have to do for school, how much reading do you usually do in a week?
	Q26	In the last two years, how many times have you changed schools because you changed where you live?
	Q27	How often do you discuss things you have studied in school with someone at home?
	Q28	Mark the statement that best describes your grades in math since sixth grade.

(table continues)

Table 12 (continued)

Composite	#	Question
Individual variables	Q29	Mark the statement that best describes your overall grades in English since sixth grade.
	Q30	Mark the statement that best describes your overall grades since sixth grade.
	Q31	How far do you think you will go in school?
	Q32	What kind of mathematics class are you taking this year?
	Q34	About how much time do you usually spend each day on mathematics homework?
	Q38	There is only one correct way to solve a mathematics problem.
	Q39	Learning mathematics is mostly memorizing facts.
	Q41	Mathematics is useful for solving everyday problems.
	Q42	If I had a choice, I would not study any more mathematics.
	Q43	Everyone can do well in mathematics if they try.
	Q44	How good at math do you think you are?
	Q45	How good at reading English do you think you are?

Note. ENGDOM, English Dominant; OTHLANG, Other Language Dominant. Composite variables were developed as proxies for non-LEP (FEP/IFE) and LEP categorizations of students, based on responses to background questions.

* Self-reported grade point average is reverse-coded.

Relation Among Students' Background Characteristics

Based on concepts or constructs measured, selected questions were grouped into composite variables, as self-reported by students in the sample:

1. level of English proficiency (understanding, speaking, reading, writing English) (ENGLWEL, Q13 to Q16);
2. availability of reading materials (such as newspapers, books, magazines and encyclopedia) in the home (READFAM, Q20 to Q23);
3. grade point average (SELFGPA, Q28 to Q30); and
4. attitudes toward math (ATTMATH, Q35 to Q37).

Intercorrelations between the four composite variables were computed (Table 13). Because of the relatively large number of students, most correlations were statistically significant. However, in most cases, the size of the correlations is not large enough to permit meaningful interpretations. The only sizable correlation was between self-reported grade points and students' attitude toward math (r = -.34, the negative sign is the result of reverse coding for GPA). One might expect to get higher correlations between these composite variables. For example, there should be a higher relationship between students' self-reported English language proficiency and their self-reported grade point average.

Table 13

Correlation Among the Selected Background (Composite) Questions

Composite variable	ENGLWEL	READFAM	SELFGPA	ATTMATH
ENGLWEL				
Coefficient	1.00	0.04	0.11	-0.05
Number of cases	(1349)	(1324)	(1311)	(1296)
Significance		0.19	0.00	0.06
READFAM				
Coefficient	0.04	1.00	-0.18	0.06
Number of cases	(1324)	(1331)	(1290)	(1277)
Significance	0.20		0.00	0.03
SELFGPA				
Coefficient	0.11	-0.18	1.00	-0.34
Number of cases	(1311)	(1290)	(1312)	(1273)
Significance	0.00	0.00		0.00
ATTMATH				
Coefficient	-0.05	0.06	-0.34	1.00
Number of cases	(1296)	(1277)	(1273)	(1296)
Significance	0.06	0.03	0.00	

Note. Composite variables developed by combining students' responses to questions about the following: ENGLWEL–Level of understanding, speaking, reading, writing English (Q13-Q16); READFAM–Availability of reading materials in the home, such as newspapers, books, magazines, and encyclopedia (Q20-Q23); SELFGPA–Students' grade point averages in math, English, overall (Q28-Q30, reverse coded); ATTMATH–Attitudes toward math (Q35-Q37).

Several reasons may account for the low correlations between these variables. First, the self-reported data are not fully reliable, and second, low-level internal consistency or multidimensionality of the scales could cause more measurement error in the composite variables, which may result in lower correlation coefficients. To examine the internal consistency of the variables used in the composite variables, an alpha coefficient was computed for each composite variable for the combined group.

As Table 14 indicates, internal consistency coefficients range from a high of 0.96 for self-reported English proficiency to a low of 0.71 for home reading materials. The lack of a relationship between the four composite variables thus may be due to measurement error of the individual questions or multidimensionality of the variables used to create the composite scores.

Table 14

Internal Consistency Coefficients of Selected Background (Composite) Variables

Item number	Alpha (a)	Scale mean if item deleted	Scale variance if item deleted	Corrected item—total correlation	Alpha if item deleted
ENGLWEL	0.96				
Q13		6.15	6.39	0.92	0.95
Q14		6.18	6.43	0.92	0.94
Q15		6.18	6.59	0.91	0.95
Q16		6.23	6.77	0.87	0.96
READFAM	0.71				
Q20		2.19	.99	0.53	0.63
Q21		2.10	1.06	0.49	0.65
Q22		1.94	1.24	0.44	0.68
Q23		2.06	1.05	0.53	0.62
SELFGPA	0.81				
Q28		4.14	3.07	0.62	0.78
Q29		4.35	2.95	0.63	0.77
Q30		4.27	2.83	0.73	0.67
ATTMATH	0.75				
Q35		7.49	2.47	0.56	0.71
Q36		7.48	2.55	0.65	0.58
Q37		7.19	3.21	0.55	0.71

Note. Composite variables were developed by combining students' responses to the following questions: ENGLWEL–Level of understanding, speaking, reading, writing English (Q13-Q16); READFAM–Availability of reading materials in the home, such as newspapers, books, magazines, and encyclopedia (Q20-Q23); SELFGPA–Students' grade point averages in math, English, overall (Q28-Q30, reverse coded); ATTMATH–Attitudes toward math (Q35-Q37).

Rather than categorizing students based on their LEP or other designation, we analyzed the feasibility of categorizing students based on their frequency of use and proficiency with a language other than English. Students with high scores on this composite variable were termed "Other Language Dominant" (as proxy for LEP students), whereas students with low scores on this composite variable were termed "English Dominant" (as proxy for FEP/IFE students).

Two additional composite variables were created, as proxies for LEP and non-LEP (FEP/IFE) status (see earlier discussion on problems surrounding LEP classifications). The first composite indicates how often the *student speaks a language other than English* with others (parents, siblings, friends at school, and friends outside of school, Q4 to Q7), and the second composite variable indicates how the student reports his/her level of *proficiency in the language other than English* (Q8 to Q11).

To see whether structural differences existed between students grouped by these background variables, we computed correlation coefficients and alphas separately for each group. The intercorrelation coefficients between composite variables and language composite variables were compared. Correlations between composite variables and with math and reading scores and the alpha coefficients were higher for the "English Dominant" group. This suggests higher internal consistency in response patterns of the "English Dominant" (non-LEP) group who understood the background questions better, as compared to the "Other Language Dominant" (LEP) group. For example, in comparing Tables 15 and 16, the average correlation (absolute values) between the four composite variables for "English Dominant" (FEP/IFE) students ($r = 0.163$) exceeded that for "Other Language Dominant" students ($r = 0.128$).

Table 15

Correlation Among the Four Composite Variables for LEP Students

Composite variable	ENGLWEL	READFAM	SELFGPA	ATTMATH
ENGLWEL				
Coefficient	1.00	0.22	-0.06	-0.04
Number of cases	(843)	(821)	(816)	(794)
Significance		0.00	0.08	0.25
READFAM				
Coefficient	0.22	1.00	-0.16	0.03
Number of cases	(821)	(821)	(798)	(778)
Significance	0.00		0.00	0.36
SELFGPA				
Coefficient	-0.06	-0.16	1.00	-0.28
Number of cases	(816)	(798)	(817)	(782)
Significance	0.08	0.00		0.00
ATTMATH				
Coefficient	-0.04	0.03	-0.28	1.00
Number of cases	(794)	(778)	(782)	(794)
Significance	0.25	0.36	0.00	

Note. Composite variables developed by combining students' responses to the following questions: ENGLWEL–Level of understanding, speaking, reading, writing English (Q13-Q16); READFAM–Availability of reading materials in the home, such as newspapers, books, magazines, and encyclopedia (Q20-Q23); SELFGPA–Students' grade point averages in math, English, overall (Q28-Q30, reverse coded); ATTMATH–Attitudes toward math (Q35-Q37).

Table 16

Correlation Among the Four Composite Variables for non-LEP Students

Composite variable	ENGLWEL	READFAM	SELFGPA	ATTMATH
ENGLWEL				
Coefficient	1.00	-0.04	0.27	-0.04
Number of cases	(505)	(502)	(494)	(501)
Significance		0.42	0.00	0.35
READFAM				
Coefficient	-0.04	1.00	-0.14	0.09
Number of cases	(502)	(509)	(491)	(498)
Significance	0.42		0.00	0.04
SELFGPA				
Coefficient	0.27	-0.14	1.00	-0.42
Number of cases	(494)	(491)	(494)	(490)
Significance	0.00	0.00		0.00
ATTMATH				
Coefficient	-0.04	0.09	-0.42	1.00
Number of cases	(501)	(498)	(490)	(501)
Significance	0.35	0.04	0.00	

Note. Composite variables developed by combining students' responses to the following questions: ENGLWEL–Level of understanding, speaking, reading, writing English (Q13-Q16); READFAM–Availability of reading materials in the home, such as newspapers, books, magazines, and encyclopedia (Q20-Q23); SELFGPA–Students' grade point averages in math, English, overall (Q28-Q30, reverse coded); ATTMATH–Attitudes toward math (Q35-Q37).

This pattern was maintained in comparisons of the internal consistency coefficients (Cronbach's α). Tables 17 and 18 present reliability findings for each of the composite variables: 1) self-reported English proficiency (LEP $\alpha = 0.92$, non-LEP $\alpha = 0.98$); 2) reading materials at home (LEP $\alpha = 0.61$, non-LEP $\alpha = 0.67$); 3) self-reported GPA (LEP $\alpha = 0.79$, non-LEP $\alpha = 0.82$); and 4) attitudes toward math (LEP $\alpha = .75$, non-LEP $\alpha = .75$).

Table 17

Internal Consistency Coefficients of the Four Composite Variables for LEP Students

Item number for composite variables	Alpha (α)	Scale mean if item deleted	Scale variance if item deleted	Corrected item—total correlation	Alpha if item deleted
ENGLWEL	0.92				
Q13		6.85	4.44	0.83	0.88
Q14		6.92	4.35	0.84	0.88
Q15		6.94	4.49	0.81	0.89
Q16		7.05	4.63	0.75	0.91
READFAM					
Q20		1.76	1.07	0.42	0.51
Q21		1.63	1.08	0.39	0.53
Q22		1.43	1.18	0.35	0.56
Q23		1.61	1.08	0.38	0.54
SELFGPA	0.79				
Q28		4.47	3.18	0.60	0.74
Q29		4.61	2.97	0.61	0.74
Q30		4.59	2.95	0.68	0.65
ATTMATH	0.75				
Q35		7.34	2.66	0.55	0.72
Q36		7.45	2.56	0.67	0.56
Q37		7.15	3.38	0.55	0.71

Note. Composite variables developed by combining students' responses to the following questions: ENGLWEL–Level of understanding, speaking, reading, writing English (Q13-Q16); READFAM–Availability of reading materials in the home, such as newspapers, books, magazines, and encyclopedia (Q20-Q23); SELFGPA–Students' grade point averages in math, English, overall (Q28-Q30, reverse coded); ATTMATH–Attitudes toward math (Q35-Q37).

These data suggest that the non-LEP group has slightly, though consistently higher correlations, and higher level of internal consistency, on the selected background questions. This suggests that LEP students, because of their lower English proficiency, may not have understood the questions as well as non-LEP students. This language factor may decrease the reliability of their responses (e.g., language is a source of error).

Table 18

Internal Consistency Coefficients of the Four Composite Variables for non-LEP Students

Item number for composite variables	Alpha (α)	Scale mean if item deleted	Scale variance if item deleted	Corrected item—total correlation	Alpha if item deleted
ENGLWEL	0.98				
Q13		5.42	7.37	0.96	0.98
Q14		5.41	7.42	0.97	0.98
Q15		5.39	7.53	0.96	0.98
Q16		5.39	7.59	0.95	0.98
READFAM	0.67				
Q20		2.63	0.52	0.47	0.59
Q21		2.58	0.59	0.43	0.61
Q22		2.45	0.78	0.38	0.65
Q23		2.53	0.59	0.56	0.52
SELFGPA	0.82				
Q28		3.80	2.75	0.63	0.80
Q29		4.06	2.80	0.64	0.79
Q30		3.94	2.52	0.77	0.66
ATTMATH	0.75				
Q35		7.66	2.25	0.57	0.70
Q36		7.52	2.46	0.65	0.58
Q37		7.24	3.03	0.54	0.72

Note. Composite variables developed by combining students' responses to the following questions: ENGLWEL–Level of understanding, speaking, reading, writing English (Q13-Q16); READFAM–Availability of reading materials in the home, such as newspapers, books, magazines, and encyclopedia (Q20-Q23); SELFGPA–Students' grade point averages in math, English, overall (Q28-Q30, reverse coded); ATTMATH–Attitudes toward math (Q35-Q37).

Relation Between Students' Background Characteristics and Math and Reading Performance

Table 19 shows correlation coefficients between the students' scores on math and reading tests and the composite background variables ($p < .01$). Correlations ranged from -.11 (self-reported English proficiency and reading score) to -.38 (self-reported GPA and math score, negative sign is the result of reverse coding). These correlation coefficients, though small, provide some evidence for validity and reliability of the self-reported background characteristics. When the correlation coefficients are significant ($p < .05$), this indicates evidence of construct validity, a checkpoint for the validity of the background questions. We would hypothesize significant correlations among certain variables within the same construct.

Table 19

Correlation Coefficient Between Composite Variables and Math and Reading Scores

Composite variable	MATHSC	READSC
ENGLWEL		
Coefficient	-0.20	-0.11
Number of cases	(1349)	(1329)
Significance	0.00	0.00
READFAM		
Coefficient	0.26	0.24
Number of cases	(1331)	(1331)
Significance	0.00	0.00
SELFGPA		
Coefficient	-0.38	-0.31
Number of cases	(1312)	(1312)
Significance	0.00	0.00
ATTMATH		
Coefficient	0.24	0.16
Number of cases	(1296)	(1296)
Significance	0.00	0.00

Note. Composite variables developed by combining students' responses to the following questions: ENGLWEL–Level of understanding, speaking, reading, writing English (Q13-Q16); READFAM–Availability of reading materials in the home, such as newspapers, books, magazines, and encyclopedia (Q20-Q23); SELFGPA–Students' grade point averages in math, English, overall (Q28-Q30, reverse coded); ATTMATH–Attitudes toward math (Q35-Q37).

Correlation coefficients between students' performance in math and reading and their background variables were also computed separately for the "English Dominant" proxy (non-LEP) and the "Other Language Dominant" proxy (LEP). Results are presented in Tables 20 and 21, respectively.

Table 20

Correlation Coefficient Between Composite Variables and Math and Reading Scores

Composite variable	MATHSC	READSC
ENGLWEL		
Coefficient	0.13	0.11
Number of cases	(843)	(843)
Significance	0.00	0.00
READFAM		
Coefficient	0.13	0.15
Number of cases	(821)	(821)
Significance	0.00	0.00
SELFGPA		
Coefficient	-0.29	-0.22
Number of cases	(817)	(817)
Significance	0.00	0.00
ATTMATH		
Coefficient	0.16	0.10
Number of cases	(794)	(794)
Significance	0.00	0.00
Average coorelation	0.178	0.145

Note. Composite variables developed by combining students' responses to the following questions: ENGLWEL–Level of understanding, speaking, reading, writing English (Q13-Q16); READFAM–Availability of reading materials in the home, such as newspapers, books, magazines, and encyclopedia (Q20-Q23); SELFGPA–Students' grade point averages in math, English, overall (Q28-Q30, reverse coded); ATTMATH–Attitudes toward math (Q35-Q37).

Table 21

Correlation Coefficient Between Composite Variables and Math and Reading Scores for non-LEP Students

Composite variable	MATHSC	READSC
ENGLWEL		
Coefficient	-0.40	-0.23
Number of cases	(505)	(505)
Significance	0.00	0.00
READFAM		
Coefficient	0.28	0.20
Number of cases	(509)	(509)
Significance	0.00	0.00
SELFGPA		
Coefficient	-0.46	-0.38
Number of cases	(494)	(494)
Significance	0.00	0.00
ATTMATH		
Coefficient	0.31	0.23
Number of cases	(501)	(501)
Significance	0.00	0.00
Average correlation	0.362	0.260

Note. Composite variables developed by combining students' responses to the following questions: ENGLWEL–Level of understanding, speaking, reading, writing English (Q13-Q16); READFAM–Availability of reading materials in the home, such as newspapers, books, magazines, and encyclopedia (Q20-Q23); SELFGPA–Students' grade point averages in math, English, overall (Q28-Q30, reverse coded); ATTMATH–Attitudes toward math (Q35-Q37).

Relations between these background variables and math and reading scores were systematically higher for non-LEP (FEP/IFE) students than for LEP students. For example, the average correlation between math and the four composites for LEP students was .178 (Table 20) as compared with an average correlation of .362 for non-LEP students (Table 21). For reading scores, the average correlation for LEP students was .145 (Table 20) as compared with the average correlation of .260 for non-LEP students (Table 21). One possible explanation for this difference is students' language background. Because of language barriers, LEP students may not have the same level of understanding of the background questions as non-LEP students (including native English speakers).

Correlation coefficients between selected individual background questions and students' math and reading scores were also computed (see Table 22). Because of the relatively large number of subjects, even a small correlation coefficient may be statistically significant (e.g., $r = .08$ is significant at $p < .01$). The data suggest that *length of time in the U.S.* (Q2) was moderately and significantly correlated with math test score ($r = .25$) and reading test score ($r = .26$). Thus, the longer a student lives in the United States, the higher his/her performance in math and reading, other things being equal.

There was also a low, but significant, correlation between *the number of hours the students watch TV* (Q24) and math performance ($r = -.09$), but not with reading performance. Finally, *extra reading activities* (Q25) was related to math test performance ($r = .13$) and reading test performance ($r = .21$). *Number of times a student changed schools* (Q26) had negative impacts on math performance ($r = -.19$) and reading performance ($r = -.15$). Finally, *self-reported grades* in math (Q28) were moderately correlated with math scores ($r = -.36$, reverse coded), whereas self-reported grades in English (Q29) had slighly lower correlations with reading scores ($r = -.26$, reverse coded).

Predictors of Math and Reading Performance

In addition to identifying the relations between specific background variables and student performance (as evidenced by correlations), we were also interested in the relative effects of selected individual background variables (see Table 12) on student performance. Two multiple regression analyses were conducted, with math and reading scores as the dependent variables respectively and selected background variables as predictors. These background variables were selected to examine their impact on students' academic progress. The two equations were run once for all students and once for the LEP students only.

Table 22

Correlation Coefficient Between Individual Variables and Math and Reading Scores for All Students

Variable	MATHSC	READSC
Years lived in U.S. (Q2)		
Coefficient	.2529	.2696
Number of cases	(1357)	(1357)
Significance	0.00	0.00
TV watched daily (Q24)		
Coefficient	-.0926	-.0027
Number of cases	(1342)	(1342)
Significance	.001	.922
Fun reading/wk (Q25)		
Coefficient	.1272	.2101
Number of cases	(1339)	(1339)
Significance	.000	.000
Times changed schools (Q26)		
Coefficient	-.1866	-.1495
Number of cases	(1341)	(1341)
Significance	.000	.000
Talk school at home (Q27)		
Coefficient	.1185	.0859
Number of cases	(1336)	(1336)
Significance	.000	.002
Math grades (Q28, reverse-coded)		
Coefficient	-.3637	-.2599
Number of cases	(1293)	(1293)
Significance	.000	.000
English grades (Q29, reverse-coded)		
Coefficient	-.2898	-.2632
Number of cases	(1294)	(1294)
Significance	.000	.000
Overall grades (Q30, reverse-coded)		
Coefficient	-.3279	-.2580
Number of cases	(1281)	(1281)
Significance	.000	.000
Far go in school (Q31)		
Coefficient	-.0518	-.1017
Number of cases	(1384)	(1384)
Significance	.054	.000

(table continues)

Table 22 (continued)

Variable	MATHSC	READSC
Kind math class (Q32)		
Coefficient	.1663	.0542
Number of cases	(1280)	(1280)
Significance	.000	.053
Time on math homework/day (Q34)		
Coefficient	-.0183	-.1299
Number of cases	(1395)	(1395)
Significance	.456	.000
One way solve math problem (Q38)		
Coefficient	-.2444	-.2719
Number of cases	(1281)	(1281)
Significance	.000	.000
Math is mostly memorization (Q39)		
Coefficient	-.1041	-.1059
Number of cases	(1277)	(1277)
Significance	.000	.000
Talking about how do math important as doing (Q40)		
Coefficient	.0669	.0489
Number of cases	(1266)	(1266)
Significance	.017	.082
Math useful solving daily problems (Q41)		
Coefficient	.1974	.1573
Number of cases	(1265)	(1265)
Significance	.000	.000
If choose, not study more math (Q42)		
Coefficient	-.1621	-.1878
Number of cases	(1261)	(1261)
Significance	.000	.000
All can do well in math if try (Q43)		
Coefficient	.0050	.0587
Number of cases	(1262)	(1262)
Significance	.860	.037
How good are you at math (Q44)		
Coefficient	.2636	.1248
Number of cases	(1266)	(1266)
Significance	.000	.000
How good are you at reading (Q45)		
Coefficient	.2512	.3226
Number of cases	(1261)	(1261)
Significance	.000	.000

Table 23 summarizes the results of multiple regression analyses using math score as the criterion variable for all students (LEP and non-LEP). The "ENTER" option in SPSS was used to obtain estimates of the power of all independent variables used in this analysis in predicting the students' math scores. The regression coefficients β (slope), standardized regression coefficient B, standard error of β, a t-test indicating the significance of the slope and a p-value associated with the *t*-statistic are reported for each variable.

Of the 19 predictors, 13 had significant contributions in predicting math scores. The multiple R for this equation was 0.59, with an R^2 of 0.35 indicating that 35% of the variance of the math scores was explained by the set of predictors used in this equation. The column under b shows (to some extent) the relative importance of the predictors. Based on the size of *b* relative to the standard error of the slope, *the length of time the students had lived in the United States* (Q2) had the highest level of predictive power. A t-statistic of 7.02 with a probability of .0000 of a Type-I error indicated that length of time in U.S. was the best predictor among the variables included in this study.

The next best predictors of students' performance in math were *times changed schools* (Q26), *how far think will go in school* (Q31), *kind of math taking in school* (Q32), *self-reported performance in math* (Q28, *grades in math since 6th grade), amount of television watched per day* (Q24), and *attitudes toward math* (Q38, *only one correct way to solve math problems*; Q41, *math is useful for solving problems*; Q43, *everyone can do well in math if try*). Thus, variables related to students' background may predict students' math performance. That is, the longer students live in the United States, the higher their performance in math. This clearly indicates that language plays an important role in learning mathematics and expressing the learned knowledge through an assessment tool in the English language. Nonetheless, additional variables (e.g., knowing the culture of schooling, number of math tests administered) may also influence performance.

Table 23

Results of Multiple Regression Analysis Predicting Math Scores from Students' Background Information (All Students)

Variable	β	SE β	Beta B	t	p
Numbers of years lived in U.S.	0.301879	0.043031	0.188917	7.015	0.0000
Television watched per day	-0.292908	0.097484	-0.077222	-3.005	0.0027
Reading for fun per week	0.160911	0.100599	0.041142	1.600	0.1100
Times changed schools	-0.751267	0.185259	-0.101500	-4.055	0.0001
Discuss school work at home	0.207998	0.159803	0.033663	1.302	0.1933
Grades in math since 6th grade (reverse-coded)	-0.939815	0.227349	-0.144490	-4.134	0.0000
Grades in English since 6th grade (reverse-coded)	-0.089561	0.223794	-0.013651	-0.400	0.6891
Overall grades since 6th grade (reverse-coded)	-0.810251	0.217689	-0.127943	-3.722	0.0002
How far went in school	0.120001	0.070947	0.041881	1.691	0.0910
Kind of mathematics taking this year	0.725332	0.144756	0.126731	5.011	0.0000
How much time spent on homework	0.232781	0.116982	0.050364	1.990	0.0468
Only one correct way to solve math problem	-0.719624	0.137265	-0.139628	-5.243	0.0000
Learning math is mostly memorizing facts	-0.460656	0.163923	-0.075457	-2.810	0.0050
Talking about math as important as doing math	0.113264	0.188999	0.016634	0.599	0.5491
Math is useful for solving problems	0.723256	0.177194	0.109956	4.082	0.0000
I would not study any more math	-0.359648	0.136420	-0.067746	-2.636	0.0085
Everyone can do well in math if he or she tries	-0.722616	0.197381	-0.099895	-3.661	0.0003
How good at math are you?	1.022407	0.243588	0.124915	4.197	0.0000
How good at reading English are you?	0.332381	0.222267	0.044481	1.495	0.1351
(Constant)	12.266806	1.754876		6.990	0.0000

Note. R = 0.58882; R^2 = 0.34670.

Other variables, though not directly related to students' language background, may reflect the cultural/socioeconomic status of some of the immigrant families. For example, *number of times changed schools* and *how far planning to continue education* are related to SES and immigration status of the family. Other important predictors mentioned above can also be categorized under academic-culture categories. Further, in some cultures students believe *that every one can do well in math if try*, whereas in other cultures, there may be no such belief.

Similar predictors were found with reading scores (see Table 24). These included *length of time lived in the United States* (Q2), *number of times changed schools* (Q26), *how far go in school* (Q31), *grades in math since 6th grade* (Q28), and *only one correct way to solve math problems* (Q38)—all important predictors of students' reading performance as well. In addition, other variables were significant predictors of students' reading score, including *reading for fun per week* (Q25), *English reading proficiency* (Q45), and *attitudes toward math* (e.g., *learning math is mostly memorizing facts*, Q39; *I would not study any more math*, Q42).

Additional regression analyses were run for LEP students only, with similar findings (see Table 25). In predicting math performance, the following background variables were the strongest predictors: *length of time in U.S.* (Q2), *grades in math* (Q28), *overall grades* (Q30), *educational aspirations* (Q31), and *attitudes toward math* (Q38, *there is only one correct way to solve math problems*; Q41, *math is useful for solving everyday problems*).

However, some variables that were significant predictors for all students (LEP and non-LEP combined) were not significant predictors for LEP students only. These included *amount of television watched* (Q24), *times changed schools* (Q26), *kind of mathematics taking this year* (Q32), *amount of time spent on homework* (Q34), and other attitudes toward math (e.g., *learning math is memorizing facts*; Q39; *everyone can do well if he or she tries*, Q43; *self-reported math proficiency*, Q44).

Table 24

Results of Multiple Regression Analysis Predicting Reading Scores from Students' Background Information (All Students)

Variable	β	SE β	Beta B	t	p
Numbers of years lived in U.S.	.0940894	.020648	.129891	4.557	.0000
Television watched per day	-.082367	.046776	-.047903	-1.761	.0785
Reading for fun per week	.238269	.048271	.134391	4.936	.0000
Times changed schools	-.189977	.088893	-.056620	-2.137	.0328
Discuss school work at home	-.022353	.076679	-.007980	-.292	.7707
Grades in math since 6th grade (reverse-coded)	-.439560	.109089	-.149079	-4.029	.0001
Grades in English since 6th grade (reverse-coded)	-.004948	.107384	-.001664	-.046	.9633
Overall grades since 6th grade (reverse-coded)	-.232016	.104454	-.080819	-2.221	.0265
How far will go in school	.094077	.034043	.072430	2.763	.0058
Kind of mathematics taking this year	.082450	.069459	.031779	1.187	.2355
How much time spent on homework	.026082	.056132	.012448	.465	.6423
Only one correct way to solve math problem	-.385405	.065864	-.164963	-5.852	.0000
Learning math is mostly memorizing facts	-.167822	.078656	-.060642	-2.134	.0331
Talking about math as important as doing math	.021206	.090688	.006870	.234	.8152
Math is useful for solving problems	.219975	.085024	.073773	2.587	.0098
I would not study any more math	-.282082	.065459	-.117214	-4.309	.0000
Everyone can do well in math if he or she tries	-.062897	.094710	-.019181	-.664	-.5068
How good at math are you?	-.064084	.116881	-.017272	-.548	.5836
How good at reading English are you?	.509563	.106651	.150432	4.778	.0000
(Constant)	4.960202	.842047		5.891	.0000

Note. R = 0.51772; R^2 = 0.26803.

Table 25

Results of Multiple Regression Analysis Predicting Math Scores from Students' Background Information (LEP Students)

Variable	β	SE β	Beta B	t	p
Numbers of years lived in U.S.	.179869	.045405	.152827	3.961	.0001
Television watched per day	.060654	.111490	.019952	.544	.5866
Reading for fun per week	.101309	.118110	.031315	.858	.3913
Times changed schools	-.390045	.207247	-.068244	-1.882	.0603
Discuss school work at home	.086744	.176530	.018200	.491	.6233
Grades in math since 6th grade (reverse-coded)	-.799515	.248685	-.156652	-3.215	.0014
Grades in English since 6th grade (reverse-coded)	-.018873	.250041	-.003661	-.075	.9399
Overall grades since 6th grade (reverse-coded)	-.526422	.235058	-.105967	-2.240	.0255
How far will go in school	.035414	.073241	.017268	.484	.6289
Kind of mathematics taking this year	.266612	.152111	.062282	1.753	.0801
How much time spent on homework	.085333	.132887	.022972	.642	.5210
Only one correct way to solve math problem	-.650976	.160862	-.152612	-4.047	.0001
Learning math is mostly memorizing facts	-.148748	.206247	-.028676	-.721	.4710
Talking about math as important as doing math	.155049	.226167	.028798	.686	.4932
Math is useful for solving problems	.462809	.200337	.092230	2.310	.0212
I would not study any more math	-.425044	.152460	-.103083	-2.788	.0055
Everyone can do well in math if he or she tries	.134209	.225440	.023638	.595	.5518
How good at math are you?	.533734	.275826	.081849	1.935	.0534
How good at reading English are you?	.010998	.249330	.001845	.044	.9648
(Constant)	10.682341	1.900290		5.621	.0000

Note. R = 0.47484; R^2 = 0.22547.

Predictors of reading scores for LEP students were consistent with those for the entire sample (see Table 26). Significant predictors included: *reading for fun* (Q25), *grades in math* (Q28), *educational aspirations* (Q31), *attitudes toward math* (Q38, *there is only one way to solve math problem*), *self-reported English reading proficiency* (Q45), *and length of time in the U.S.* (Q2). However, similar to math, some significant variables with the full sample were not significant for LEP students only. These included: *number of times changed schools* (Q26), and attitudes toward math (Q39, *learning math is memorizing facts*).

In summary, the multiple regression analyses indicated that many selected background variables, particularly those related to students' language background, were powerful predictors of students' performance in math and reading.

Item-level Analyses

As indicated earlier, math test items were examined for linguistic features that students might find difficult. The original and the linguistically modified test items were placed in two different test booklets and randomly assigned to eighth-grade students within each class. Random assignment of booklets reduced sources of bias or other threats to internal validity due to selection factors, such as school, teacher, and other effects.

Thus, significant differences between the performance of the students taking the original items and those taking the modified items could be attributed to language modification of the items. The results discussed earlier reveal significant differences between students' performance on the math items, differing only by linguistic demands and the LEP category classification. Students performed highest on the modified English version ($M = 13.84$, $SD = 6.92$, $n = 593$), followed by the original English version ($M = 13.10$, $SD = 6.33$, $n = 559$), and lowest on the Spanish language version ($M = 9.04$, $SD = 3.67$, $n = 242$). Based on these initial differences, it was necessary to see whether the pattern varied across individual test items as well. That is, are some math test items impacted more by language modification than others?

Table 26

Results of Multiple Regression Analysis Predicting Reading Scores from Students' Background Information (LEP Students)

Variable	β	SE β	Beta B	t	p
Numbers of years lived in U.S.	0.062051	0.024556	0.099249	2.527	0.0117
Television watched per day	0.063015	0.060298	0.039021	1.045	0.2964
Reading for fun per week	0.283236	0.063878	0.164809	4.434	0.0000
Times changed schools	-0.083333	0.112087	-0.027447	-0.743	0.4575
Discuss school work at home	-0.031844	0.095474	-0.012578	-0.334	0.7388
Grades in math since 6th grade (reverse-coded)	-0.291047	0.134498	-0.107351	-2.164	0.0308
Grades in English since 6th grade (reverse-coded)	-0.092641	0.135231	-0.033831	-0.685	0.4935
Overall grades since 6th grade (reverse-coded)	-0.120223	0.127128	-0.045557	-0.946	0.3447
How far went in school	0.086633	0.039611	0.079522	2.187	0.0291
Kind of mathematics taking this year	-0.021818	0.082267	-0.009595	-0.265	0.7909
How much time spent on homework	-0.023724	0.071870	-0.012022	-0.330	0.7414
Only one correct way to solve math problem	-0.324330	0.087000	-0.143135	-3.728	0.0002
Learning math is mostly memorizing facts	-0.047762	0.111546	-0.017333	-0.428	0.6687
Talking about math as important as doing math	0.062174	0.122319	0.021739	0.508	0.6114
Math is useful for solving problems	0.077100	0.108349	0.028924	0.712	0.4770
I would not study any more math	-0.214157	0.082455	-0.097773	-2.597	0.0096
Everyone can do well in math if he or she tries	0.129005	0.121926	0.042772	1.058	0.2904
How good at math are you?	-0.165968	0.149176	-0.047912	-1.113	0.2663
How good at reading English are you?	0.419062	0.134847	0.132322	3.108	0.0020
(Constant)	3.699925	1.027744		3.600	0.0003

Note. R = 0.41469; R^2 = 0.17197.

To examine the level of impact of language modification on individual test items, the proportion of correct answers (p-value) for the dichotomously scored items and the mean scores for other types of items were computed and compared across the original/modified dimension. Booklets were assigned randomly to students, any significant difference between the difficulty level of item would show the impact of language modification (see Table 27). For each item, item mean, item standard deviation, mean difference between original and modified versions, a t-test examining the significance of the difference and the associated p-value for a Type-I error, and finally, a coefficient of determination or the proportion of the variance of item explained by language modification process are reported.

Of the 35 items, 17 (49%) had significantly higher ($p < .05$) mean scores in the modified English booklet; 4 items had significantly lower mean scores in the modified English booklet. Of the 35 items in the original test booklet, 29 items were modified linguistically. The remaining 6 items were judged to be linguistically noncomplex and were identical in both booklets (original and modified). Among the 29 modified items, 18 comparisons with original items showed significant results for all students ($p < .05$). In 14 of these 18 cases, students performed higher on the modified version than the originals. The η^2 (proportion of the variance explained), however, is small, which indicates that only a small portion of the variance of test items is explained by the process of linguistic modification. In these comparisons, the pooled variance for all the math items was used in the computation of the t-ratios to avoid the increase of the Type-I error rate due to the multiple comparisons. Further analyses are being conducted to investigate whether type of modification and extent of modification of items affected math scores.

Six math items (7, 8, 14, 17, 18, 21) were judged to be noncomplex linguistically, so no modifications were made; thus, these items were identical in both test booklets. Nevertheless, three of these items showed small but significant increases in mean scores when they occurred with modified items. A possible explanation is that the task of reading the modified items is less demanding, leaving more time and attention for solving the nonmodified items in that booklet. Thus, the increase in scores on these items is not a direct result of any modifications to these individual items, but can be regarded as an indirect

Table 27

Comparing the Mean Scores of Original and Modified Items in Math

	Original		Modified					
Item #	M	SD	M	SD	Mean Diff.	t	p	η*
1	0.56	0.50	0.61	0.49	.05	1.65	0.002	0.05
2	0.16	0.37	0.23	0.42	.07	3.28	0.000	0.10
3	0.59	0.49	0.63	0.48	.04	1.37	0.007	0.04
4	0.40	0.49	0.39	0.49	-.01	-0.29	0.563	0.01
5	0.19	0.39	0.33	0.47	.14	5.48	0.000	0.16
6	0.13	0.34	0.17	0.38	.04	1.87	0.000	0.06
7**	0.85	0.36	0.93	0.25	.08	4.69	0.000	0.14
8**	0.84	0.37	0.87	0.34	.03	1.34	0.007	0.04
9	0.64	0.48	0.64	0.48	.00	0.10	0.839	0.00
10	0.70	0.46	0.80	0.40	.10	3.68	0.000	0.11
11	0.55	0.50	0.49	0.50	-.06	-1.91	0.014	0.06
12	0.59	0.49	0.59	0.49	.00	-0.22	0.666	0.01
13	0.34	0.47	0.28	0.45	-.06	-1.90	0.000	0.06
14**	0.27	0.45	0.31	0.46	.04	1.29	0.010	0.04
15	0.25	0.44	0.30	0.46	.05	1.67	0.001	0.05
16	0.41	0.49	0.44	0.50	.03	1.02	0.044	0.03
17**	0.26	0.44	0.29	0.45	.03	0.81	0.104	0.02
18**	0.26	0.44	0.25	0.44	-.01	-0.13	0.792	0.00
19	0.14	0.35	0.12	0.33	-.02	-1.01	0.043	0.03
20	0.52	0.50	0.53	0.50	.01	0.28	0.584	0.01
21**	0.52	0.50	0.50	0.50	-.02	-.58	0.366	0.02
22	0.41	0.49	0.44	0.50	.03	1.02	0.044	0.03
23	0.41	0.49	0.34	0.47	-.07	-2.63	0.000	0.08
24	0.38	0.49	0.39	0.49	.01	0.40	0.425	0.01
25	0.44	0.50	0.42	0.49	-.02	-0.71	0.160	0.02
26	0.15	0.36	0.15	0.36	.00	0.14	0.782	0.00
27	0.17	0.37	0.17	0.38	.00	0.17	0.740	0.00
28	0.20	0.40	0.21	0.41	.01	0.65	0.192	0.02

(table continues)

Table 27 (continued)

	Original		Modified					
Item #	M	SD	M	SD	Mean Diff.	t	p	η*
29	0.36	0.48	0.45	0.50	.09	3.07	0.000	0.09
30	0.44	0.50	0.45	0.50	.01	0.20	0.685	0.01
31	0.18	0.38	0.21	0.41	.03	1.21	0.015	0.04
32	0.34	0.47	0.39	0.49	.05	1.97	0.000	0.06
33	0.07	0.26	0.12	0.33	.05	2.82	0.000	0.08
34	0.18	0.38	0.18	0.38	.00	-0.01	0.984	0.00
35	0.22	0.42	0.25	0.43	.03	1.03	0.039	0.03

* Square root of coefficient of determination.

* * Math item not linguistically modified.

indirect effect on overall test performance due to the composition of the whole test booklet.

Summary of Study

In this study, we examined the impact of students' background variables on their performance in math. We selected this subject area because it typically has not been linked with students' language capabilities. We changed the wording of the items to reduce their linguistic complexity, based on a linguistic rubric developed for this purpose. Care was taken to avoid altering special mathematics vocabulary and structures; only the nontechnical, "ordinary" language of the items was modified.

We randomly assigned the three test booklets (modified English, original English, and original Spanish) to students in each classroom. Random assignment of test booklets minimized the effects due to teacher, class, school, and several other possible sources of threat to internal validity due to selection. A simple two-factor completely crossed ANOVA showed significant differences between the eighth-grade students' performance across the three booklets (for math items in original or modified English, versus math items in Spanish) and for the LEP/non-LEP groups. Students performed highest on the modified

English version, lower on the original English version, and lowest on the original Spanish version.

The difference between students' performance on the English versions (original English and modified versions) and the Spanish version was much higher than the differences between the original and the modified versions. That is, students in this study performed poorly on the Spanish version as compared with the average score of the two English versions. The main reason behind this difference may be the language of the students' math instruction. The data suggest that students perform better on math tests that are conducted in their language of math instruction. A student may be a native speaker of Spanish, but if s/he has learned math concepts and technical vocabulary through the medium of the English language, s/he will perform better on the math test that uses English.

In general, the results of this study indicate that clarifying the language of the test helped all students improve their performance. We plan to do other comparisons to see if students with different background characteristics would benefit differently from the language modification of items. Our previous studies suggest the students in the middle- or lower-level math classes can benefit more from language simplification of items than students in the higher-level math classes. Further analyses will answer this and other questions concerning the relationship of students' background characteristics and their performance.

Item-level analyses indicated that the language modification of items helped students improve their performance in about 49% of the items (17 out of 35). For math items for which a modified version was created, in 14 out of 29 items, students performed significantly better on the modified version. Certain types of linguistic modifications may have contributed more than others to the significant math score differences. Preliminary item-level analysis suggests that item length may have had a stronger impact than other complexity variables, for example. Further item-level analyses are being conducted to identify any patterns of differential impact of linguistic modifications.

Multiple regression analyses, predicting math and reading scores from students' background questions, indicated that background variables such as length of time residing in the United States are good predictors of students' performance in math and reading. Approximately 35% of the variance on the math test and 27% of the variance on the reading test were predicted from 19 background variables used as predictors. Length of time living in the United States was the strongest predictor of students' performance in math. These results indicate that students' background variables are important indications in interpreting the assessment results for students with limited English proficiency.

Analyses on the language background questionnaire indicated that there are structural differences between LEP and non-LEP students on the relationship between the self-reported background questions, particularly in the language background variables. Students with limited English proficiency seem to have more difficulty reading and understanding the background questions. Reliability coefficients (internal consistency coefficients) were significantly lower for LEP students, indicating additional sources of measurement error for LEP students, perhaps due to language proficiency.

Implications

These findings have numerous implications for developing selection criteria for participation in the NAEP math tests, as well as accommodation strategies for students with limited English proficiency. These include:

- Students' proficiency in academic English may be a suitable indicator of preparedness for participation in the NAEP math tests. A language proficiency measure is an essential component of LEP instruction and assessment. With such information, accommodations could be suggested for students based on their English language proficiency.

- Student background variables may serve as indicators of preparedness for participation in the NAEP math tests, including length of time a student has lived in the United States.

- Linguistically clarified test items may be used as a form of accommodation for LEP students. Further, it appears that all students, both LEP and non-LEP, would benefit from more clearly worded math items. Language, however, is especially confounding for students designated as LEP.

- Translating assessment tasks into the students' native language is frequently assumed to be a good accommodation strategy. Our data suggest otherwise. Translating test items from English to other languages may not necessarily accommodate LEP students when their language of instruction is English. In summary, the data suggest that students perform most effectively when the language of the math test matches their language of instruction.

Recommendations

Based on the findings of this study, and existing research on developing and analyzing test accommodations for English language learners, specifically students designated as limited English proficient (LEP), we recommend the following:

- If LEP status is used as one of the selection criteria, a more objective, nationwide operational definition of the term "limited English proficiency" is needed. In this study, usage of the student designation "Limited English Proficient" (LEP) proved problematic due to arbitrary and varying classification criteria across schools. Thus students designated as LEP at one school might not be designated as LEP at another school. This has implications for which students are included in the NAEP testing.

- The current analyses are based on a total sample of LEP and non-LEP students. Math performance, native language proficiency, and English proficiency may vary among subgroups of students by native language (e.g., Spanish, Vietnamese, Cambodian). Additional analyses are necessary to identify possible differences in the effect of language accommodations on different subgroups.

- More attention should be given to the feasibility of administering different forms of accommodations for LEP students. If the most effective form of accommodation is not practical or logistically possible, it may not be useful. Thus, our recommendation is to build in the "feasibility factor" as one of the main research issues in any studies dealing with accommodations for any group of students.

These recommendations are based on several studies conducted at UCLA/CRESST. However, caution must be exercised in using these recommendations, because the studies are based on a relatively small sample (an *n* of approximately 1400 students in each of our studies) and non-nationally representative subjects.

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Appendix A

Student Background Questionnaire

Teacher Classroom Questionnaire

Student Background Questionnaire

1. What country do you come from? ____

2. How long have you lived in the United States? ____________ years

3. Do you speak a language besides English? ❐ Yes ❐ No

   If **yes**, what is that language? ________________________
   If **no**, skip down to question #12.

4. How much do you speak that language with your parents?

Always or most of the time	Sometimes	Never or hardly ever
❐	❐	❐

5. How much do you speak that language with your brothers and sisters?

Always or most of the time	Sometimes	Never or hardly ever
❐	❐	❐

6. How much do you speak that language with your friends at school?

Always or most of the time	Sometimes	Never or hardly ever
❐	❐	❐

7. How much do you speak that language with your friends **outside** school?

Always or most of the time	Sometimes	Never or hardly ever
❐	❐	❐

8. Do you **speak** that language well?

Very well	Fairly well	Not very well
❐	❐	❐

9. Do you **understand** that language well?

Very well	Fairly well	Not very well
❐	❐	❐

10. Do you **read** that language well?

Very well	Fairly well	Not very well
❐	❐	❐

11. Do you **write** that language well?

Very well	Fairly well	Not very well
❒	❒	❒

12. If you have homework that you don't understand, and you need to ask a friend how to do it, what language do you like to use?

English?	Your other language?
❒	❒

13. Do you **understand spoken English** well?

Very well	Fairly well	Not very well
❒	❒	❒

14. Do you **speak English** well?

Very well	Fairly well	Not very well
❒	❒	❒

15. Do you **read English** well?

Very well	Fairly well	Not very well
❒	❒	❒

16. Do you **write English** well?

Very well	Fairly well	Not very well
❒	❒	❒

17. Are you a male or a female?

Male	Female
❒	❒

18. What is your zipcode? ________________

19. Which best describes you?

❒ White (not Hispanic)
❒ Black (not Hispanic)
❒ Hispanic
❒ Asian or Pacific Islander
❒ American Indian or Alaskan Native
❒ Other __________________________

20. Does your family get an English language newspaper regularly?

Yes	No	I don't know
❒	❒	❒

21. Is there an English encyclopedia in your home?

Yes	No	I don't know
❐	❐	❐

22. Are there more than 25 books in English in your home?

Yes	No	I don't know
❐	❐	❐

23. Does your family get any English language magazines?

Yes	No	I don't know
❐	❐	❐

24. How much television do you watch in a day?

❐ None
❐ 1 hour or less
❐ 2 hours
❐ 3 hours
❐ 4 hours
❐ 5 hours
❐ 6 hours or more

25. How much reading do you do in a week **for fun** (not schoolwork)?

❐ None
❐ 1 hour or less
❐ 2 hours
❐ 3 hours
❐ 4 hours
❐ 5 hours
❐ 6 hours or more

26. In the last two years, how many times have you changed schools because you moved?

❐ None
❐ 1
❐ 2
❐ 3 or more

27. How often do you talk about schoolwork with someone at home?

❐ Almost every day
❐ Once or twice a week
❐ Once or twice a month
❐ Never or hardly ever

28. What are your grades in math since sixth grade?

❒ Mostly As
❒ Mostly Bs
❒ Mostly Cs
❒ Mostly Ds
❒ Mostly below D
❒ Classes not graded

29. What are your grades in English since sixth grade?

❒ Mostly As
❒ Mostly Bs
❒ Mostly Cs
❒ Mostly Ds
❒ Mostly below D
❒ Classes not graded

30. What are your grades as a whole since sixth grade?

❒ Mostly As
❒ Mostly Bs
❒ Mostly Cs
❒ Mostly Ds
❒ Mostly below D
❒ Classes not graded

31. How far do you think you will go in school?

❒ I will not finish high school.
❒ I will graduate from high school.
❒ I will have some education after high school.
❒ I will graduate from college.
❒ I will go to graduate school.
❒ I don't know.

32. What kind of mathematics class are you taking this year?

❒ I am not taking mathematics this year.
❒ Eighth-grade mathematics
❒ Prealgebra
❒ Algebra
❒ Integrated or sequential mathematics
❒ Applied Mathematics (technical preparation)
❒ Other mathematics class

33. What kind of mathematics class do you expect to take next year?

- ❒ I do not expect to take mathematics next year.
- ❒ Basic, general, business, or consumer mathematics
- ❒ Applied mathematics (technical preparation)
- ❒ Prealgebra
- ❒ Algebra I or elementary algebra
- ❒ Integrated or sequential mathematics
- ❒ Other mathematics class
- ❒ I don't know.

34. How much time do you spend on mathematics homework **in a day**?

- ❒ I am not taking mathematics this year.
- ❒ None
- ❒ 15 minutes
- ❒ 30 minutes
- ❒ 45 minutes
- ❒ One hour
- ❒ More than one hour.

35. I like mathematics.

Strongly agree	Agree	Undecided	Disagree	Strongly disagree
❒	❒	❒	❒	❒

36. I am good at mathematics.

Strongly agree	Agree	Undecided	Disagree	Strongly disagree
❒	❒	❒	❒	❒

37. I understand most of what goes on in mathematics class.

Strongly agree	Agree	Undecided	Disagree	Strongly disagree
❒	❒	❒	❒	❒

38. There is only one correct way to solve a mathematics problem.

Strongly agree	Agree	Undecided	Disagree	Strongly disagree
❒	❒	❒	❒	❒

39. Learning mathematics is mostly memorizing facts.

Strongly agree	Agree	Undecided	Disagree	Strongly disagree
❒	❒	❒	❒	❒

40. Being good at talking about mathematics is as important as being good at doing mathematics.

Strongly agree	Agree	Undecided	Disagree	Strongly disagree
❒	❒	❒	❒	❒

41. Mathematics is useful for solving situations in the real world.

Strongly agree	Agree	Undecided	Disagree	Strongly disagree
❒	❒	❒	❒	❒

42. If I could choose, I would not study more mathematics.

Strongly agree	Agree	Undecided	Disagree	Strongly disagree
❒	❒	❒	❒	❒

43. Everyone can do well in mathematics if they try.

Strongly agree	Agree	Undecided	Disagree	Strongly disagree
❒	❒	❒	❒	❒

44. Do you think you are good at math?

❒ Very good at math
❒ Good at math
❒ Average at math
❒ Poor at math

45. Do you think you are good at reading English?

❒ Very good at reading English
❒ Good at reading English
❒ Average at reading English
❒ Poor at reading English

UCLA Language Background Study
Teacher Classroom Context Questionnaire

School Name ____________________ Teacher Name ____________________

Class Time ____________________ Type of Class ____________________

1. How many months have you been teaching this classroom of students? ________ months

2. How many students are in your class (present at time of testing)? ________

3. How many of the students in your class are:
   a. Limited English Proficient (LEP)—non-native English speakers ____________
   b. Initially Fluent in English (IFE)—native English speakers ____________

4. In terms of *ethnic background*, what percentage of these students are (total 100%):
   a. Latino/Hispanic ______%
   b. Caucasian ______%
   c. African-American ______%
   d. Asian/Pacific Islander ______%
   e. Other ________________ ______%
   f. Other ________________ ______%

5. In terms of *native language* what percentage of students speak (total 100%):
   a. English ______%
   b. Spanish ______%
   c. Bilingual (Span/Eng) ______%
   d. ________________ ______%
   e. ________________ ______%
   f. ________________ ______%

6. To the best of your knowledge, about what percentage of your students receive (total 100%):
   a. free lunches ______%
   b. reduced-price lunches ______%
   c. not applicable ______%

7. In terms of *general math achievement*, what percentage of these students are in (total 100%):
   a. low-level math (remediation, basic arithmetic) ______%
   b. medium-level math (fractions, decimals, pre-algebra) ______%
   c. high-level math (high math, honors, algebra) ______%

9. In terms of *writing* English proficiency, what percentage of these students are (total 100%):

   a. Completely fluent in writing the English language ________%

   b. Somewhat fluent in writing the English language ________%

   c. Not at all fluent in writing the English language ________%

10. In terms of *oral* English proficiency, what percentage of these students are (total 100%):

   a. Completely fluent in speaking the English language ________%

   b. Somewhat fluent in speaking the English language ________%

   c. Not at all fluent in speaking the English language ________%

Thank you very much for your time and assistance!

Appendix B

Linguistic Complexity Variables

Linguistic Complexity Variables

The linguistic features have been divided into four groups based on the method of determining item ratings.

Group A: by computer program

1. Length: number of words in item
2. Length: number of characters in item
3. Maximum word length in item
4. Length: number of sentences in item (open-ended sentence counts as one)

Group B: by English grammar expert

5. Length of nominals:
    a. number of pre-nominal modifiers in item: include nouns, adjectives and participles, not articles or quantifiers
    b. number of post-nominal modifiers in item: include prepositional phrases and participial modifiers
6. Voice of verb phrase: number of verbs in passive voice in item
7. Modal verbs: number of modals in item (*should, would, could, may, might, must*)
8. Relative clauses: frequency + classification re position and complexity
    a. number of relative clauses in item
    b. number of non-final relative clauses
    c. number of relative clauses with noun other than subject of clause equivalent to head noun
9. Adverbial clauses and phrases
    a. number of adverbial clauses in item
    b. number of sentence-initial adverbial phrases and clauses
10. Conditional clauses: frequency + classification re position in sentence
    a. number of conditional clauses in item
    b. number of non-sentence-initial conditional clauses
11. Complement clauses: number of that-clauses, for-to complements, sentential subjects, object-complement “small clauses,” noun complement clauses

12. Question phrases: rated from 1 to 5 as follows.

'How many' 'How many NP' 'How much' 'How much NP' 'Who' Yes/No question	'Which' 'Which NP' 'What' 'What NP' Imperative action verb ('draw...'; 'subtract...')	'How many of NP' Question word omitted or not fronted in clause ('he needs how many....'; 'the sum is ____.')	'Which of the NP' 'How many more' 'How many NP larger'	'Why' 'How' 'At what point' Question phrase begins with preposition or other non-WH word Imperative verb: 'Explain....'; '....to explain....'

Group C: by eighth-grade language and culture expert

13. Level of interest, appeal or relevance to student group of the non-mathematical, non-scientific content of the item (concepts, events); rate from 1 to 5 as follows.

All 8th graders would regard content as relevant to self and/or interesting, fun	Most 8th graders would regard content as relevant to self and/or interesting, fun	Neither dull, boring, nor interesting, fun	Some 8th graders would regard content as not relevant to self and/or dull, boring	All 8th graders would regard content as not relevant to self and/or dull, boring

14. Familiarity/frequency of nonmathematical, nonscientific vocabulary in item (compared to written language the student has encountered previously); rate from 1 to 5 as follows.

All 8th graders will be familiar with all words in item; all are relatively frequent	Majority of 8th graders will be familiar with all words in item	Item contains a low-frequency word that is possibly unfamiliar to some 8th graders	Item contains a low-frequency word likely to be unfamiliar to some 8th graders, OR two words possibly unfamiliar to some	Item contains more than one low-frequency word likely to be unfamiliar to some 8th graders, OR more than two words possibly unfamiliar to some

Group D: calculated by combining other ratings

15. Average word length (#2 / #1)
16. Average number of words per sentence in item (#1 / #4)
17. Average number of pre-nominal modifiers per sentence (#5a / #4)
18. Average number of post-nominal modifiers per sentence (#5b / #4)
19. Number of pre- and post-nominal modifiers (#5a + #5b)
20. Average number of pre- and post-nominal modifiers per sentence (#19 / #4)
21. Average number of verbs in passive voice per sentence (#6 / #4)
22. Average number of modals per sentence (#7 / #4)
23. Average number of relative clauses per sentence (#8a / #4)
24. Average number of difficult relative clauses per sentence (#8b + #8c / #4)

25. Average number of adverbial clauses per sentence (#9a / #4)
26. Average number of sentence-initial adverbial phrases and clauses per sentence (#9b / #5)
27. Average number of complement clauses per sentence (#11 / #4)
28. Average number of clauses per sentence (#15 / #4)
29. Number of subordinate clauses in item (#8a + #9a + #11)
30. Number of clauses in item (#29 + #4)

Appendix C

Additional Tables

Table C1

Hispanic and Total Samples: Participants Who Speak Languages Other than English (Items 3A, 3B)

	Is this your first language?		
Language	Yes	Valid %	Missing
Hispanic sample			
Spanish	750	96	34
Total: 784			
Total sample			
Spanish	793	76	
Cambodian	85	8	
Khmer	44	4	
Vietnamese	20	2	
Other Asian (Korean, Thai, Chinese, Japanese, Lao, Hmong, Tagalog, Samoan)	51	5	
Other (Armenian, French, Farsi, Egyptian)	49	5	
Total	1042	100	352

Note. 1042 students reported speaking a second language. More than 25% of the sample did not respond to this question. This may include English speakers (20%).

Table C2

Hispanic and Total Samples: Responses From Non-Native Speakers of English to the Question, "How often do you speak that (native) language?" (Items 4-7)

	Always or most of the time	Sometimes	Never or hardly at all	Missing
Hispanic sample				
With your parents?	481	184	128	54
	53.3%	23.5%	16.3%	6.9%
With your siblings?	247	351	120	66
	31.5%	44.8%	15.3%	8.4%
At school?	186	412	131	55
	23.7%	52.6%	16.7%	7.0%
Outside of school?	178	439	113	54
	22.7%	52.0%	14.4%	6.9%
Total: 784				
Total sample				
With your parents?	555	300	189	350
	39.8%	21.5%	13.6%	25.1%
With your siblings?	339	514	176	365
	24.3%	36.9%	12.6%	26.2%
At school?	285	559	202	348
	20.4%	40.1%	14.5%	25.0%
Outside of school?	281	563	200	350
	20.2%	40.4%	14.3%	25.1%
Total: 1394				

Note. Only students whose native languages are not English are tabulated.

Table C3

Hispanic and Total Samples: Responses from Non-Native Speakers of English to the Question, "How well do you use that (native) language?" (Items 8-11)

	Very well	Fairly well	Not well	Missing
Hispanic sample				
Understand that language?	391	204	133	56
	49.9%	26.0%	17.0%	7.1%
Speak that language?	343	244	139	58
	43.8%	31.1%	17.7%	7.4%
Read that language?	294	252	181	57
	37.5%	32.1%	23.1%	7.3%
Write that language?	302	255	168	59
	38.5%	32.5%	21.4%	7.5%
Total: 784				
Total sample				
Understand that language?	509	333	203	349
	36.5%	23.9%	14.6%	25.0%
Speak that language?	445	390	207	352
	31.9%	28.0%	14.8%	25.3%
Read that language?	407	312	323	352
	29.2%	22.4%	23.2%	25.3%
Write that language?	414	317	309	354
	29.7%	22.7%	22.2%	25.4%
Total: 1394				

Table C4

Hispanic and Total Samples: Responses to the Question, "How well do you use English?" (Items 13-16)

	Very well	Fairly well	Not well	Missing
Hispanic sample				
Understand spoken English?	395	177	196	16
	50.4%	22.6%	25.0%	2.0%
Speak English?	370	206	191	17
	47.2%	26.3%	24.4%	2.2%
Read English?	337	245	184	18
	43.0%	31.3%	23.5%	2.3%
Write English?	288	284	198	14
	36.7%	36.2%	25.3%	1.8%
Total: 784				
Total sample				
Understand spoken English?	652	249	440	53
	46.8%	17.9%	31.6%	3.8%
Speak English?	615	295	432	52
	44.1%	21.2%	31.0%	3.7%
Read English?	569	365	408	52
	40.8%	26.2%	29.3%	3.7%
Write English?	521	393	431	49
	37.4%	28.2%	30.9%	3.5%
Total: 1394				

Table C5

Hispanic Sample: Means and Standard Deviations of Responses from Non-Native Speakers of English to the Question, "How often do you speak that language with your parents?" (Item 4)

Background variables	Mean	Standard deviation	Cases
Full subsample			
Non-native speakers of English	2.3986	.7705	725
Gender			
Male	2.4401	.7555	384
Female	2.3542	.7782	336
Ethnicity			
White (not Hispanic)	2.5417	.7790	24
African American (not Hispanic)	1.8000	.7888	10
Hispanic	2.3997	.7679	648
Asian/Pacific Islander	3.0000	.0000	2
American Indian–Alaskan	2.5000	.7071	2
Other	2.2963	.8234	27
Missing			71
ESL code assigned by school			
Limited English Proficient (LEP)	2.4891	.7278	595
Fluent English Proficient (FEP)/ Initially Fluent in English (IFE)	1.9587	.8103	121
Kind of math taking this year			
Not taking math	2.3846	.6504	13
8th-grade math	2.4722	.7395	432
Pre-algebra	2.3364	.7696	110
Algebra	1.9551	.8382	89
Integrated-Sequential math	2.3636	.8090	11
Applied math (tech prep)	2.5000	.5774	4
Other	2.5333	.7303	30
Total valid cases: 750			

Note. Only students whose native languages are not English are tabulated.

Responses: 1 = never or hardly ever; 2 = sometimes; 3 = always or most of the time.

Table C6

Hispanic Sample: Means and Standard Deviations of Responses from Non-Native Speakers of English to the Question, "How often do you speak that language with your siblings?" (Item 5)

Background variables	Mean	Standard deviation	Cases
Full subsample			
Non-native speakers of English	2.1795	.6900	713
Gender			
Male	2.1864	.6916	381
Female	2.1616	.6961	328
Ethnicity			
White (not Hispanic)	2.4000	.7071	25
African American (not Hispanic)	1.6667	.7071	9
Hispanic	2.1648	.6865	637
Asian/Pacific Islander	2.0000	.0000	1
American Indian–Alaskan	3.0000	.0000	2
Other	2.1481	.7698	27
Missing			83
ESL code assigned by school			
Limited English Proficient (LEP)	2.2027	.6849	587
Fluent English Proficient (FEP)/ Initially Fluent in English (IFE)	2.0339	.7272	118
Kind of math taking this year			
Not taking math	2.1429	.7703	14
8th-grade math	2.1509	.6882	424
Pre-algebra	2.2897	.6731	107
Algebra	2.0690	.6785	87
Integrated-Sequential math	2.0909	.7006	11
Applied math (tech prep)	2.0000	.8165	4
Other	2.3000	.7022	30
Total valid cases: 750			

Note. Only students whose native languages are not English are tabulated.

Responses: 1 = never or hardly ever; 2 = sometimes; 3 = always or most of the time.

Table C7

Hispanic Sample: Means and Standard Deviations of Responses from Non-Native Speakers of English to the Question, "How often do you speak that language at school?" (Item 6)

Background variables	Mean	Standard deviation	Cases
Full subsample			
Non-native speakers of English	2.0869	.6258	728
Gender			
Male	2.1068	.6395	384
Female	2.0685	.6119	336
Ethnicity			
White (not Hispanic)	2.5100	.5099	25
African American (not Hispanic)	1.7000	.6749	10
Hispanic	2.0773	.6223	647
Asian/Pacific Islander	2.0000	.0000	2
American Indian–Alaskan	2.0000	1.4142	2
Other	2.0370	.6493	27
Missing			7
ESL code assigned by school			
Limited English Proficient (LEP)	2.0756	.6298	595
Fluent English Proficient (FEP)/ Initially Fluent in English (IFE)	2.1983	.6003	121
Kind of math taking this year			
Not taking math	2.4286	.7559	14
8th-grade math	2.0626	.6275	431
Pre-algebra	2.0727	.6311	110
Algebra	2.1124	.5728	89
Integrated-Sequential math	2.2727	.7862	11
Applied math (tech prep)	2.5000	.5774	4
Other	2.0667	.6915	30
Total valid cases: 750			

Note. Only students whose native languages are not English are tabulated.

Responses: 1 = never or hardly ever; 2 = sometimes; 3 = always or most of the time.

Table C8

Hispanic Sample: Means and Standard Deviations of Responses from Non-Native Speakers of English to the Question, "How often do you speak that language outside of school?" (Item 7)

Background variables	Mean	Standard deviation	Cases
Full subsample			
Non-native speakers of English	2.0773	.6545	724
Gender			
Male	2.0807	.6711	384
Female	2.0657	.6394	335
Ethnicity			
White (not Hispanic)	2.4400	.5831	25
African American (not Hispanic)	1.6667	.7071	9
Hispanic	2.0696	.6511	647
Asian/Pacific Islander	2.0000	.0000	2
American Indian–Alaskan	2.0000	1.4142	2
Other	1.9259	.6752	27
Missing			72
ESL code assigned by school			
Limited English Proficient (LEP)	2.0773	.6517	595
Fluent English Proficient (FEP)/ Initially Fluent in English (IFE)	2.0917	.6610	120
Kind of math taking this year			
Not taking math	2.0000	.8771	14
8th-grade math	2.0812	.6544	431
Pre-algebra	2.0642	.6841	109
Algebra	2.0225	.6026	89
Integrated-Sequential math	2.0909	.8312	11
Applied math (tech prep)	2.5000	.5774	4
Other	2.0667	.5833	30
Total valid cases: 750			

Note. Only students whose native languages are not English are tabulated.

Responses: 1 = never or hardly ever; 2 = sometimes; 3 = always or most of the time.

Table C9

Hispanic Sample: Means and Standard Deviations of Responses from Non Native Speakers of English to the Question, "How well do you speak that (native) language?" (Item 8)

Background variables	Mean	Standard deviation	Cases
Full subsample			
Non-native speakers of English	2.2816	.7673	721
Gender			
Male	2.2880	.7673	382
Female	2.2844	.7553	334
Ethnicity			
White (not Hispanic)	2.4400	.7118	25
African American (not Hispanic)	1.6667	.7071	9
Hispanic	2.2811	.7689	644
Asian/Pacific Islander	1.5000	.7071	2
American Indian–Alaskan	2.5000	.7071	2
Other	2.4074	.6360	27
Missing			75
ESL code assigned by school			
Limited English Proficient (LEP)	2.3564	.7447	592
Fluent English Proficient (FEP)/ Initially Fluent in English (IFE)	1.9083	.7447	120
Kind of math taking this year			
Not taking math	2.5000	.6504	14
8th-grade math	2.3224	.7489	428
Pre-algebra	2.2385	.7118	109
Algebra	2.0225	.8391	89
Integrated-Sequential math	2.0909	.8312	11
Applied math (tech prep)	2.2500	.9574	4
Other	2.4000	.7701	30
Total valid cases: 750			

Note. Only students whose native languages are not English are tabulated.

Responses: 1 = not very well; 2 = fairly well; 3 = very well.

Table C10

Hispanic Sample: Means and Standard Deviations of Responses from Non-Native Speakers of English to the Question, "How well do you understand that (native) language?" (Item 9)

Background variables	Mean	Standard deviation	Cases
Full subsample			
Non-native speakers of English	2.3527	.7727	723
Gender			
Male	2.3750	.7648	384
Female	2.3403	.7723	335
Ethnicity			
White (not Hispanic)	2.4000	.7071	25
African American (not Hispanic)	1.8000	.7888	10
Hispanic	2.3591	.7763	646
Asian/Pacific Islander	1.5000	.7071	2
American Indian–Alaskan	3.0000	.0000	2
Other	2.4074	.8047	27
Missing			72
ESL code assigned by school			
Limited English Proficient (LEP)	2.4401	.7399	593
Fluent English Proficient (FEP)/ Initially Fluent in English (IFE)	1.9504	.8047	121
Kind of math taking this year			
Not taking math	2.6429	.6333	14
8th-grade math	2.4153	.7387	431
Pre-algebra	2.2273	.7622	110
Algebra	1.9888	.8854	89
Integrated-Sequential math	2.1818	.8739	11
Applied math (tech prep)	2.7500	.50000	4
Other	2.5862	.6823	29
Total valid cases: 750			

Note. Only students whose native languages are not English are tabulated.

Responses: 1 = not very well; 2 = fairly well; 3 = very well.

Table C11

Hispanic Sample: Means and Standard Deviations of Responses from Non-Native Speakers of English to the Question, "How well do you read that (native) language?" (Item 10)

Background variables	Mean	Standard deviation	Cases
Full subsample			
Non-native speakers of English	2.1565	.7947	722
Gender			
Male	2.1097	.7949	383
Female	2.2149	.7863	335
Ethnicity			
White (not Hispanic)	2.4400	.8206	25
African American (not Hispanic)	1.7778	.9718	9
Hispanic	2.1471	.7885	646
Asian/Pacific Islander	2.0000	1.4142	2
American Indian–Alaskan	2.0000	1.4142	2
Other	2.1852	.7357	27
Missing			73
ESL code assigned by school			
Limited English Proficient (LEP)	2.1771	.7953	593
Fluent English Proficient (FEP)/ Initially Fluent in English (IFE)	2.0583	.7702	120
Kind of math taking this year			
Not taking math	1.9286	.8287	14
8th-grade math	2.1558	.7942	430
Pre-algebra	2.1927	.7755	109
Algebra	2.0449	.8245	89
Integrated-Sequential math	2.0909	.8312	11
Applied math (tech prep)	2.0000	.8165	4
Other	2.2667	.7397	30
Total valid cases: 750			

Note. Only students whose native languages are not English are tabulated.

Responses: 1 = not very well; 2 = fairly well; 3 = very well.

Table C12

Hispanic Sample: Means and Standard Deviations of Responses from Non-Native Speakers of English to the Question, "How well do you write that (native) language?" (Item 11)

Background variables	Mean	Standard deviation	Cases
Full subsample			
Non-native speakers of English	2.1847	.7862	720
Gender			
Male	2.1522	.7833	381
Female	2.2328	.7774	335
Ethnicity			
White (not Hispanic)	2.5200	.7141	25
African American (not Hispanic)	1.4444	.7265	9
Hispanic	2.1876	.7805	645
Asian/Pacific Islander	1.5000	.7071	2
American Indian–Alaskan	1.5000	.7071	2
Other	2.1923	.7497	26
Missing			75
ESL code assigned by school			
Limited English Proficient (LEP)	2.1912	.8644	591
Fluent English Proficient (FEP)/ Initially Fluent in English (IFE)	2.1500	.7741	120
Kind of math taking this year			
Not taking math	1.8571	.8644	14
8th-grade math	2.1795	.7901	429
Pre-algebra	2.2844	.7465	109
Algebra	2.1236	.7952	89
Integrated-Sequential math	1.9091	.7006	11
Applied math (tech prep)	2.0000	.8165	4
Other	2.1333	.7761	30
Total valid cases: 750			

Note. Only students whose native languages are not English are tabulated.

Responses: 1 = not very well; 2 = fairly well; 3 = very well.

Table C13

Hispanic Sample: Means and Standard Deviations of Responses to the Question, "How well do you understand spoken English?" (Item 13)

Background variables	Mean	Standard deviation	Cases
Full subsample	2.2576	.8379	761
Gender			
Male	2.2695	.8260	397
Female	2.2672	.8492	363
Ethnicity			
White (not Hispanic)	2.0800	.9967	25
African American (not Hispanic)	2.1000	.9944	10
Hispanic	2.2555	.8345	685
Asian/Pacific Islander	2.5000	.7071	2
American Indian–Alaskan	2.0000	1.4142	2
Other	2.3704	.8389	27
Missing			33
ESL code assigned by school			
Limited English Proficient (LEP)	2.3762	.7844	606
Fluent English Proficient (FEP)/ Initially Fluent in English (IFE)	1.7664	.9015	137
Kind of math taking this year			
Not taking math	2.5882	.6183	17
8th-grade math	2.3540	.7927	452
Pre-algebra	2.1429	.9090	112
Algebra	1.8788	.8953	99
Integrated-Sequential math	2.0000	.9535	12
Applied math (tech prep)	2.5000	.5774	4
Other	2.3871	.7606	31
Total valid cases: 784			

Note. Responses: 1 = not very well; 2 = fairly well; 3 = very well.

Table C14

Hispanic Sample: Means and Standard Deviations of Responses to the Question, "How well do you speak English?" (Item 14)

Background variables	Mean	Standard deviation	Cases
Full subsample	2.2329	.8227	760
Gender			
Male	2.2437	.8114	398
Female	2.2465	.8284	361
Ethnicity			
White (not Hispanic)	1.8800	.8813	25
African American (not Hispanic)	2.1000	.9944	10
Hispanic	2.2383	.8190	684
Asian/Pacific Islander	2.5000	.7071	2
American Indian–Alaskan	2.0000	1.4142	2
Other	2.3704	.7917	27
Missing			34
ESL code assigned by school			
Limited English Proficient (LEP)	2.3350	.7746	606
Fluent English Proficient (FEP)/ Initially Fluent in English (IFE)	1.7883	.8947	137
Kind of math taking this year			
Not taking math	2.7059	.5879	17
8th-grade math	2.3267	.7797	450
Pre-algebra	2.0982	.8798	112
Algebra	1.8283	.8576	99
Integrated-Sequential math	2.2500	.8660	12
Applied math (tech prep)	2.7500	.5000	4
Other	2.2500	.7184	32
Total valid cases: 784			

Note. Responses: 1 = not very well; 2 = fairly well; 3 = very well.

Table C15

Hispanic Sample: Means and Standard Deviations of Responses to the Question, "How well do you read English?" (Item 15)

Background variables	Mean	Standard deviation	Cases
Full subsample	2.2042	.8002	759
Gender			
Male	2.2111	.7844	398
Female	2.2111	.8107	360
Ethnicity			
White (not Hispanic)	1.8800	.8813	25
African American (not Hispanic)	2.4000	.8433	10
Hispanic	2.2050	.7934	683
Asian/Pacific Islander	2.5000	.7071	2
American Indian–Alaskan	2.5000	.7071	2
Other	2.2593	.8590	27
Missing			35
ESL code assigned by school			
Limited English Proficient (LEP)	2.3013	.7544	604
Fluent English Proficient (FEP)/ Initially Fluent in English (IFE)	1.7664	.8511	137
Kind of math taking this year			
Not taking math	2.4118	.7123	17
8th-grade math	2.3038	.7650	451
Pre-algebra	2.0714	.8459	112
Algebra	1.8351	.8251	97
Integrated-Sequential math	2.1667	.9374	12
Applied math (tech prep)	2.5000	.5774	4
Other	2.2188	.7507	32
Total valid cases: 784			

Note. Responses: 1 = not very well; 2 = fairly well; 3 = very well.

Table C16

Hispanic Sample: Means and Standard Deviations of Responses to the Question, "How well do you write English?" (Item 16)

Background variables	Mean	Standard deviation	Cases
Full subsample	2.1152	.7859	738
Gender			
Male	2.1181	.7668	398
Female	2.1322	.8034	363
Ethnicity			
White (not Hispanic)	1.7600	.7234	25
African American (not Hispanic)	2.4000	.8433	10
Hispanic	2.1297	.7862	686
Asian/Pacific Islander	2.5000	.7071	2
American Indian–Alaskan	2.0000	.0000	2
Other	2.0741	.7808	27
Missing			32
ESL code assigned by school			
Limited English Proficient (LEP)	2.1990	.7494	608
Fluent English Proficient (FEP)/ Initially Fluent in English (IFE)	1.7226	.8110	137
Kind of math taking this year			
Not taking math	2.0588	.7475	17
8th-grade math	2.2345	.7696	452
Pre-algebra	2.0536	.8257	112
Algebra	1.7980	.7690	99
Integrated-Sequential math	1.9167	.9003	12
Applied math (tech prep)	2.2500	.9574	4
Other	1.8438	.6773	32
Total valid cases: 784			

Note. Responses: 1 = not very well; 2 = fairly well; 3 = very well.

Table C17

Total Sample: Means and Standard Deviations of Responses from Non-Native Speakers of English to the Question, "How often do you speak that language with your parents?" (Item 4)

Background variables	Mean	Standard deviation	Cases
Full subsample			
Non-native speakers of English	2.3500	.7679	1023
Gender			
Male	2.3884	.7542	551
Female	2.3125	.7823	480
Ethnicity			
White (not Hispanic)	2.4222	.7830	45
African American (not Hispanic)	2.2273	.8691	22
Hispanic	2.4246	.7606	690
Asian/Pacific Islander	2.1415	.7373	205
American Indian–Alaskan	2.6667	.5164	6
Other	2.1400	.8084	50
Missing			376
ESL code assigned by school			
Limited English Proficient (LEP)	2.4447	.7293	823
Fluent English Proficient (FEP)/ Initially Fluent in English (IFE)	1.9955	.8081	220
Kind of math taking this year			
Not taking math	2.1579	.6882	19
8th-grade math	2.4603	.7333	541
Pre-algebra	2.2970	.7404	202
Algebra	1.9337	.8101	166
Integrated-Sequential math	2.3846	.7679	13
Applied math (tech prep)	2.6250	.5175	8
Other	2.4865	.7682	37
Total valid cases: 1055			

Note. Only students whose native languages are not English are tabulated.

Responses: 1 = never or hardly ever; 2 = sometimes; 3 = always or most of the time.

Table C18

Total Sample: Means and Standard Deviations of Responses from Non-Native Speakers of English to the Question, "How often do you speak that language with your siblings?" (Item 5)

Background variables	Mean	Standard deviation	Cases
Full subsample			
Non-native speakers of English	2.1567	.6841	1008
Gender			
Male	2.1548	.6939	549
Female	2.1581	.6868	468
Ethnicity			
White (not Hispanic)	2.4783	.7223	46
African American (not Hispanic)	2.1905	.8729	21
Hispanic	2.1956	.6854	680
Asian/Pacific Islander	1.9356	.6074	202
American Indian–Alaskan	2.3333	.8165	6
Other	2.0625	.7553	48
Missing			394
ESL code assigned by school			
Limited English Proficient (LEP)	2.1703	.6786	816
Fluent English Proficient (FEP)/ Initially Fluent in English (IFE)	2.1085	.7302	212
Kind of math taking this year			
Not taking math	2.0000	.7255	20
8th-grade math	2.1573	.6914	534
Pre-algebra	2.1859	.6671	199
Algebra	2.0625	.6793	160
Integrated-Sequential math	2.0769	.7596	13
Applied math (tech prep)	2.2500	.7071	8
Other	2.2973	.7403	37
Total valid cases: 1055			

Note. Only students whose native languages are not English are tabulated.

Responses: 1 = never or hardly ever; 2 = sometimes; 3 = always or most of the time.

Table C19

Total Sample: Means and Standard Deviations of Responses from Non-Native Speakers of English to the Question, "How often do you speak that language at school?" (Item 6)

Background variables	Mean	Standard deviation	Cases
Full subsample			
Non-native speakers of English	2.0724	.6702	1022
Gender			
Male	2.0544	.6880	551
Female	2.1063	.6583	480
Ethnicity			
White (not Hispanic)	2.5652	.5832	46
African American (not Hispanic)	2.2609	.8643	23
Hispanic	2.1103	.6329	689
Asian/Pacific Islander	1.8824	.7129	204
American Indian–Alaskan	1.6667	1.0328	6
Other	1.9800	.7140	50
Missing			376
ESL code assigned by school			
Limited English Proficient (LEP)	2.0450	.6616	822
Fluent English Proficient (FEP)/ Initially Fluent in English (IFE)	2.2036	.7066	221
Kind of math taking this year			
Not taking math	2.2632	.7335	19
8th-grade math	2.0778	.6571	540
Pre-algebra	1.9852	.6928	203
Algebra	2.1747	.6873	166
Integrated-Sequential math	2.1538	.8006	13
Applied math (tech prep)	2.0000	.9258	8
Other	2.0270	.6866	37
Total valid cases: 1055			

Note. Only students whose native languages are not English are tabulated.

Responses: 1 = never or hardly ever; 2 = sometimes; 3 = always or most of the time.

Table C20

Total Sample: Means and Standard Deviations of Responses from Non-Native Speakers of English to the Question, "How often do you speak that language outside of school?" (Item 7)

Background variables	Mean	Standard deviation	Cases
Full subsample			
Non-native speakers of English	2.0781	.6718	1024
Gender			
Male	2.0705	.6866	553
Female	2.0898	.6678	479
Ethnicity			
White (not Hispanic)	2.3913	.6490	46
African American (not Hispanic)	2.2273	.8691	22
Hispanic	2.1014	.6586	690
Asian/Pacific Islander	1.9463	.6657	205
American Indian–Alaskan	1.5000	.8367	6
Other	1.9800	.7140	50
Missing			375
ESL code assigned by school			
Limited English Proficient (LEP)	2.0570	.6722	825
Fluent English Proficient (FEP)/ Initially Fluent in English (IFE)	2.1682	.6917	220
Kind of math taking this year			
Not taking math	1.9000	.8522	20
8th-grade math	2.1128	.6751	541
Pre-algebra	2.0396	.6827	202
Algebra	2.0723	.6566	166
Integrated-Sequential math	1.8571	.8644	14
Applied math (tech prep)	2.3750	.7440	8
Other	2.0000	.6236	37
Total valid cases: 1055			

Note. Only students whose native languages are not English are tabulated.

Responses: 1 = never or hardly ever; 2 = sometimes; 3 = always or most of the time.

Table C21

Total Sample: Means and Standard Deviations of Responses from Non Native Speakers of English to the Question, "How well do you speak that (native) language?" (Item 8)

Background variables	Mean	Standard deviation	Cases
Full subsample			
Non-native speakers of English	2.2255	.7571	1021
Gender			
Male	2.2486	.7519	551
Female	2.2113	.7602	478
Ethnicity			
White (not Hispanic)	2.2609	.7434	46
African American (not Hispanic)	2.2727	.8827	22
Hispanic	2.2897	.7706	687
Asian/Pacific Islander	2.0195	.6785	205
American Indian–Alaskan	2.3333	.8165	6
Other	2.2400	.7160	50
Missing			378
ESL code assigned by school			
Limited English Proficient (LEP)	2.2935	.7427	821
Fluent English Proficient (FEP)/ Initially Fluent in English (IFE)	1.9864	.7674	220
Kind of math taking this year			
Not taking math	2.3500	.7452	20
8th-grade math	2.3030	.7494	538
Pre-algebra	2.1881	.6723	202
Algebra	1.9639	.8007	166
Integrated-Sequential math	1.9231	.8623	13
Applied math (tech prep)	2.5000	.7559	8
Other	2.3243	.7837	37
Total valid cases: 1055			

Note. Only students whose native languages are not English are tabulated.

Responses: 1 = not very well; 2 = fairly well; 3 = very well.

Table C22

Total Sample: Means and Standard Deviations of Responses from Non-Native Speakers of English to the Question, "How well do you understand that (native) language?" (Item 9)

Background variables	Mean	Standard deviation	Cases
Full subsample			
Non-native speakers of English	2.2893	.7715	1023
Gender			
Male	2.3327	.7670	553
Female	2.2547	.7721	479
Ethnicity			
White (not Hispanic)	2.1957	.7780	46
African American (not Hispanic)	2.1739	.8869	23
Hispanic	2.3628	.7769	689
Asian/Pacific Islander	2.0976	.7073	205
American Indian–Alaskan	2.8333	.4082	6
Other	2.2600	.7775	50
Missing			375
ESL code assigned by school			
Limited English Proficient (LEP)	2.3779	.7444	823
Fluent English Proficient (FEP)/ Initially Fluent in English (IFE)	1.9774	.7945	221
Kind of math taking this year			
Not taking math	2.5000	.6882	20
8th-grade math	2.3900	.7462	541
Pre-algebra	2.1921	.7227	203
Algebra	1.9337	.8249	166
Integrated-Sequential math	1.9286	.9169	14
Applied math (tech prep)	2.6250	.5175	8
Other	2.5278	.7362	36
Total valid cases: 1055			

Note. Only students whose native languages are not English are tabulated.

Responses: 1 = not very well; 2 = fairly well; 3 = very well.

Table C23

Hispanic Sample: Means and Standard Deviations of Responses from Non-Native Speakers of English to the Question, "How well do you read that (native) language?" (Item 10)

Background variables	Mean	Standard deviation	Cases
Full subsample			
Non-native speakers of English	2.0784	.8334	1020
Gender			
Male	2.0290	.8299	552
Female	2.1464	.8314	478
Ethnicity			
White (not Hispanic)	2.3478	.7949	46
African American (not Hispanic)	2.1818	.9580	22
Hispanic	2.1541	.7908	688
Asian/Pacific Islander	1.7707	.8972	205
American Indian–Alaskan	1.6667	.8165	6
Other	2.0400	.8071	50
Missing			377
ESL code assigned by school			
Limited English Proficient (LEP)	2.0621	.8394	821
Fluent English Proficient (FEP)/ Initially Fluent in English (IFE)	2.1500	.8110	220
Kind of math taking this year			
Not taking math	1.9000	.7881	20
8th-grade math	2.1039	.8182	539
Pre-algebra	1.9901	.8638	202
Algebra	2.0843	.8486	166
Integrated-Sequential math	2.0769	.8623	13
Applied math (tech prep)	2.5000	.7559	8
Other	2.1622	.7998	37
Total valid cases: 1055			

Note. Only students whose native languages are not English are tabulated.

Responses: 1 = not very well; 2 = fairly well; 3 = very well.

Table C24

Hispanic Sample: Means and Standard Deviations of Responses from Non-Native Speakers of English to the Question, "How well do you write that (native) language?" (Item 11)

Background variables	Mean	Standard deviation	Cases
Full subsample			
Non-native speakers of English	2.0982	.8274	1018
Gender			
Male	2.0582	.8299	550
Female	2.1590	.8190	478
Ethnicity			
White (not Hispanic)	2.3478	.7369	46
African American (not Hispanic)	2.1818	.9069	22
Hispanic	2.1965	.7829	687
Asian/Pacific Islander	1.7805	.8887	205
American Indian–Alaskan	2.0000	.8944	6
Other	1.9388	.8268	49
Missing			379
ESL code assigned by school			
Limited English Proficient (LEP)	2.0684	.8319	819
Fluent English Proficient (FEP)/ Initially Fluent in English (IFE)	2.2227	.8055	220
Kind of math taking this year			
Not taking math	1.9000	.9119	20
8th-grade math	2.1245	.8172	538
Pre-algebra	2.0446	.8598	202
Algebra	2.1205	.8224	166
Integrated-Sequential math	1.7692	.7250	13
Applied math (tech prep)	2.3750	.7440	8
Other	2.0541	.8147	37
Total valid cases: 1055			

Note. Only students whose native languages are not English are tabulated.

Responses: 1 = not very well; 2 = fairly well; 3 = very well.

Table C25

Total Sample: Means and Standard Deviations of Responses to the Question, “How well do you understand spoken English?” (Item 13)

Background variables	Mean	Standard Deviation	Cases
Full subsample	2.1460	.8891	1308
Gender			
Male	2.1969	.8789	711
Female	2.1183	.8995	617
Ethnicity			
White (not Hispanic)	1.5349	.8678	172
African American (not Hispanic)	2.5052	.8554	97
Hispanic	2.1957	.8506	736
Asian/Pacific Islander	2.2222	.8554	216
American Indian–Alaskan	2.1538	.9871	13
Other	2.3714	.8542	70
Missing			90
ESL code assigned by school			
Limited English Proficient (LEP)	2.3179	.8098	840
Fluent English Proficient (FEP)/ Initially Fluent in English (IFE)	1.8880	.9493	500
Kind of math taking this year			
Not taking math	2.6000	.6455	25
8th-grade math	2.3476	.8121	630
Pre-algebra	2.1395	.9261	294
Algebra	1.6085	.8449	258
Integrated-Sequential math	1.9375	.9287	16
Applied math (tech prep)	2.2500	.8864	8
Other	2.3256	.8083	43
Total valid cases: 1394			

Note. Responses: 1 = not very well; 2 = fairly well; 3 = very well.

Table C26

Total Sample: Means and Standard Deviations of Responses to the Question, "How well do you speak English?" (Item 14)

Background variables	Mean	Standard deviation	Cases
Full subsample	2.1229	.8737	1310
Gender			
Male	2.1674	.8665	711
Female	2.1086	.8769	617
Ethnicity			
White (not Hispanic)	1.5263	.8424	171
African American (not Hispanic)	2.4949	.8497	99
Hispanic	2.1796	.8387	735
Asian/Pacific Islander	2.1574	.8259	216
American Indian–Alaskan	2.3846	.8697	13
Other	2.3857	.8391	70
Missing			90
ESL code assigned by school			
Limited English Proficient (LEP)	2.2753	.7993	839
Fluent English Proficient (FEP)/ Initially Fluent in English (IFE)	1.9024	.9395	502
Kind of math taking this year			
Not taking math	2.6400	.7000	25
8th-grade math	2.3232	.8061	628
Pre-algebra	2.0918	.8908	294
Algebra	1.5930	.8187	258
Integrated-Sequential math	2.0000	.8660	17
Applied math (tech prep)	2.3750	.7440	8
Other	2.2500	.7813	44
Total valid cases: 1394			

Note. Responses: 1 = not very well; 2 = fairly well; 3 = very well.

Table C27

Total Sample: Means and Standard Deviations of Responses to the Question, "How well do you read English?" (Item 15)

Background variables	Mean	Standard deviation	Cases
Full subsample	2.1092	.8453	1310
Gender			
Male	2.1515	.8293	713
Female	2.0893	.8593	616
Ethnicity			
White (not Hispanic)	1.5556	.8125	171
African American (not Hispanic)	2.5000	.7977	100
Hispanic	2.1471	.8110	734
Asian/Pacific Islander	2.1475	.8145	217
American Indian–Alaskan	2.2308	.8321	13
Other	2.3571	.8171	70
Missing			89
ESL code assigned by school			
Limited English Proficient (LEP)	2.2509	.7744	837
Fluent English Proficient (FEP)/ Initially Fluent in English (IFE)	1.9008	.9106	504
Kind of math taking this year			
Not taking math	2.5600	.6506	25
8th-grade math	2.3052	.7874	629
Pre-algebra	2.0811	.8754	296
Algebra	1.6055	.7699	256
Integrated-Sequential math	2.0625	.9287	16
Applied math (tech prep)	2.2500	.7071	8
Other	2.2273	.7735	44
Total valid cases: 1394			

Note. Responses: 1 = not very well; 2 = fairly well; 3 = very well.

Table C28

Total Sample: Means and Standard Deviations of Responses to the Question, "How well do you write English?" (Item 16)

Background variables	Mean	Standard deviation	Cases
Full subsample	2.0548	.8383	1313
Gender			
Male	2.0913	.8157	712
Female	2.0420	.8636	619
Ethnicity			
White (not Hispanic)	1.5647	.7912	170
African American (not Hispanic)	2.5100	.8102	100
Hispanic	2.0719	.8035	737
Asian/Pacific Islander	2.1336	.8365	217
American Indian–Alaskan	2.0769	.8623	13
Other	2.2571	.8109	70
Missing			87
ESL code assigned by school			
Limited English Proficient (LEP)	2.1641	.7787	841
Fluent English Proficient (FEP)/ Initially Fluent in English (IFE)	1.9026	.9084	503
Kind of math taking this year			
Not taking math	2.2000	.7638	25
8th-grade math	2.2492	.7973	630
Pre-algebra	2.0777	.8581	296
Algebra	1.5875	.7662	257
Integrated-Sequential math	1.8125	.8342	16
Applied math (tech prep)	2.1250	.8345	8
Other	1.9318	.7594	44
Total valid cases: 1394			

Note. Responses: 1 = not very well; 2 = fairly well; 3 = very well.

Table C29

Total Sample: Means and Standard Deviations of Responses from LEP and FEP/IFE Students to the Question, "How often do you speak that language with your parents?" (Item 4)

Background variables	LEP			FEP/IFE		
	Mean	SD	N	Mean	SD	N
Full sample	2.4447	.7293	823	1.9955	.8081	220
Gender						
Male	2.4464	.7215	448	2.1262	.8364	103
Female	2.4478	.7386	364	1.8879	.7664	116
Ethnicity						
White (not Hispanic)	2.3333	.8681	24	2.5238	.6796	21
African American (not Hispanic)	2.0000	.7559	8	2.3571	.9288	14
Hispanic	2.5217	.7150	575	1.9298	.7951	114
Asian/Pacific Islander	2.2244	.7146	156	1.8776	.7537	49
American Indian–Alaskan	2.6000	.5477	5	3.0000	----	1
Other	2.2571	.7413	35	1.8667	.9155	15
Kind of math taking this year						
Not taking math	2.2353	.6642	17	1.5000	.7071	2
8th-grade math	2.5184	.7026	461	2.1139	.8163	79
Pre-algebra	2.3358	.7304	137	2.2154	.7602	65
Algebra	2.1250	.8088	104	1.6129	.7095	62
Integrated-Sequential math	2.5000	.6742	12	1.0000	----	1
Applied math (tech prep)	2.8333	.4082	6	2.0000	.0000	2
Other	2.5152	.7550	33	2.2500	.9574	4
Total valid cases: 1394						

Note. School designations: LEP (Limited English Proficient); FEP (Fluent English Proficient); IFE (Initially Fluent in English). Responses: 1 = never or hardly ever; 2 = sometimes; 3 = always or most of the time.

Table C30

Total Sample: Means and Standard Deviations of Responses from LEP and FEP/IFE Students to the Question, "How often do you speak that language with your siblings?" (Item 5)

	LEP			FEP/IFE		
Background variables	Mean	SD	N	Mean	SD	N
Full sample	2.1703	.6786	816	2.1085	.7302	212
Gender						
Male	2.1588	.6792	447	2.1275	.7535	102
Female	2.1788	.6789	358	2.0909	.7109	110
Ethnicity						
White (not Hispanic)	2.3200	.7483	25	2.6667	.6583	21
African American (not Hispanic)	1.8750	.8345	8	2.3846	.8697	13
Hispanic	2.2236	.6780	568	2.0450	.7057	111
Asian/Pacific Islander	1.9032	.5786	155	2.0426	.6902	47
American Indian–Alaskan	2.4000	.8944	5	2.0000	----	1
Other	2.1429	.7334	35	1.8462	.8006	13
Kind of math taking this year						
Not taking math	2.0000	.7670	18	2.0000	.0000	2
8th-grade math	2.1908	.6768	456	1.9481	.7416	77
Pre-algebra	2.1407	.6483	135	2.2813	.7008	64
Algebra	2.0388	.6704	103	2.1053	.6991	57
Integrated-Sequential math	2.0833	.7930	12	2.0000	----	1
Applied math (tech prep)	2.5000	.5477	6	1.5000	.7071	2
Other	2.2727	.7191	33	2.5000	1.000	4
Total valid cases: 1394						

Note. School designations: LEP (Limited English Proficient); FEP (Fluent English Proficient); IFE (Initially Fluent in English). Responses: 1 = never or hardly ever; 2 = sometimes; 3 = always or most of the time.

Table C31

Total Sample: Means and Standard Deviations of Responses from LEP and FEP/IFE Students to the Question, "How often do you speak that language at school?" (Item 6)

Background variables	LEP			FEP/IFE		
	Mean	SD	N	Mean	SD	N
Full sample	2.0450	.6616	822	2.2036	.7066	221
Gender						
Male	2.0268	.6824	447	2.1731	.7029	104
Female	2.0632	.6375	364	2.2414	.7055	116
Ethnicity						
White (not Hispanic)	2.3600	.5686	25	2.8095	.5118	21
African American (not Hispanic)	1.8750	.8345	8	2.4667	.8338	15
Hispanic	2.1115	.6402	574	2.1140	.5914	114
Asian/Pacific Islander	1.7806	.6474	155	2.2041	.8160	49
American Indian–Alaskan	1.8000	1.0954	5	1.0000	----	1
Other	1.9143	.7017	35	2.1333	.7432	15
Kind of math taking this year						
Not taking math	2.3529	.7019	17	1.5000	.7071	2
8th-grade math	2.0913	.6537	460	2.0127	.6697	79
Pre-algebra	1.8686	.6162	137	2.2273	.7804	66
Algebra	2.0192	.6965	104	2.4355	.5901	62
Integrated-Sequential math	2.0833	.7930	12	3.0000	----	1
Applied math (tech prep)	1.8333	.9832	6	2.5000	.7071	2
Other	2.0303	.6366	33	2.0000	1.1547	4
Total valid cases: 1394						

Note. School designations: LEP (Limited English Proficient); FEP (Fluent English Proficient); IFE (Initially Fluent in English). Responses: 1 = never or hardly ever; 2 = sometimes; 3 = always or most of the time.

Table C32

Total Sample: Means and Standard Deviations of Responses from LEP and FEP/IFE Students to the Question, "How often do you speak that language outside school?" (Item 7)

	LEP			FEP/IFE		
Background variables	Mean	SD	N	Mean	SD	N
Full sample	2.0570	.6722	825	2.1682	.6917	220
Gender						
Male	2.0579	.6822	449	2.1346	.6975	104
Female	2.0572	.6598	364	2.2087	.6818	115
Ethnicity						
White (not Hispanic)	2.2800	.5416	25	2.5238	.7496	21
African American (not Hispanic)	1.7500	.8864	8	2.5000	.7596	14
Hispanic	2.1200	.6635	575	2.6175	.6238	114
Asian/Pacific Islander	1.8397	.6273	156	2.2857	.6770	49
American Indian–Alaskan	1.6000	.8944	5	1.0000	----	1
Other	1.9143	.7425	35	2.1333	.6399	15
Kind of math taking this year						
Not taking math	2.0000	.8402	18	1.0000	.0000	2
8th-grade math	2.1171	.6719	461	2.1013	.6905	79
Pre-algebra	1.9416	.6274	137	2.2462	.7506	65
Algebra	1.9904	.6754	104	2.2097	.6043	62
Integrated-Sequential math	1.8462	.8987	13	2.0000	----	1
Applied math (tech prep)	2.5000	.8367	6	2.0000	.0000	2
Other	1.9697	.5855	33	2.2500	.9574	4
Total valid cases: 1394						

Note. School designations: LEP (Limited English Proficient); FEP (Fluent English Proficient); IFE (Initially Fluent in English). Responses: 1 = never or hardly ever; 2 = sometimes; 3 = always or most of the time.

Table C33

Total Sample: Means and Standard Deviations of Responses from LEP and FEP/IFE Students to the Question, "How well do you speak that language?" (Item 8)

Background variables	LEP			FEP/IFE		
	Mean	SD	N	Mean	SD	N
Full sample	2.2935	.7427	821	1.9864	.7674	220
Gender						
Male	2.2908	.7399	447	2.0673	.7792	104
Female	2.3030	.7408	363	1.9217	.7510	115
Ethnicity						
White (not Hispanic)	2.4000	.8165	25	2.0952	.6249	21
African American (not Hispanic)	1.7500	.8864	8	2.5714	.7559	14
Hispanic	2.3671	.7450	572	1.9035	.7867	114
Asian/Pacific Islander	2.0577	.6549	156	1.8980	.7429	49
American Indian–Alaskan	2.2000	.8367	5	3.0000	----	1
Other	2.3143	.6761	35	2.0667	.7988	15
Kind of math taking this year						
Not taking math	2.3889	.7775	18	2.0000	.0000	2
8th-grade math	2.3341	.7395	458	2.1266	.7904	79
Pre-algebra	2.2044	.6546	137	2.1538	.7122	65
Algebra	2.1538	.8098	104	1.6452	.6798	62
Integrated-Sequential math	2.0000	.8528	12	1.0000	----	1
Applied math (tech prep)	2.8333	.4082	6	1.5000	.7071	2
Other	2.3333	.7773	33	2.2500	.9574	4
Total valid cases: 1394						

Note. School designations: LEP (Limited English Proficient); FEP (Fluent English Proficient); IFE (Initially Fluent in English). Responses: 1 = not very well; 2 = fairly well; 3 = very well.

Table C34

Total Sample: Means and Standard Deviations of Responses from LEP and FEP/IFE Students to the Question, "How well do you understand that language?" (Item 9)

Background variables	LEP			FEP/IFE		
	Mean	SD	N	Mean	SD	N
Full sample	2.3779	.7444	823	1.9774	.7945	221
Gender						
Male	2.3898	.7422	449	2.0865	.8257	104
Female	2.3719	.7410	363	1.8879	.7549	116
Ethnicity						
White (not Hispanic)	2.4000	.8165	25	1.9524	.6690	21
African American (not Hispanic)	1.8750	.9910	8	2.3333	.8165	15
Hispanic	2.4477	.7402	574	1.9386	.8232	114
Asian/Pacific Islander	2.1731	.6925	156	1.8571	.7071	49
American Indian–Alaskan	2.8000	.4472	5	3.0000	----	1
Other	2.3143	.7183	35	2.1333	.9155	15
Kind of math taking this year						
Not taking math	2.6111	.6077	18	1.5000	.7071	2
8th-grade math	2.4208	.7348	461	2.2152	.7954	79
Pre-algebra	2.2409	.7228	137	2.0909	.7174	66
Algebra	2.1923	.8253	104	1.5000	.6207	62
Integrated-Sequential math	2.0000	.9129	13	1.0000	----	1
Applied math (tech prep)	2.5000	.5477	6	3.0000	.0000	2
Other	2.5313	.7177	32	2.5800	1.000	4
Total valid cases: 1394						

Note. School designations: LEP (Limited English Proficient); FEP (Fluent English Proficient); IFE (Initially Fluent in English). Responses: 1 = not very well; 2 = fairly well; 3 = very well.

Table C35

Total Sample: Means and Standard Deviations of Responses from LEP and FEP/IFE Students to the Question, "How well do you read that language?" (Item 10)

Background variables	LEP			FEP/IFE		
	Mean	SD	N	Mean	SD	N
Full sample	2.0621	.8394	821	2.1500	.8110	220
Gender						
Male	2.0201	.8339	448	2.0577	.8223	104
Female	2.1157	.8428	363	2.2435	.7902	115
Ethnicity						
White (not Hispanic)	2.2800	.8907	25	2.4286	.6761	21
African American (not Hispanic)	2.1250	.9910	8	2.2143	.9750	14
Hispanic	2.1763	.7924	573	2.0439	.7802	114
Asian/Pacific Islander	1.5897	.8337	156	2.3469	.8552	49
American Indian–Alaskan	1.6000	.8944	5	2.0000	----	1
Other	1.9714	.8220	35	2.2000	.7746	15
Kind of math taking this year						
Not taking math	1.9444	.8024	18	1.5000	.7071	2
8th-grade math	2.1220	.8189	459	2.0000	.8165	79
Pre-algebra	1.8467	.8566	137	2.2923	.8047	65
Algebra	1.9712	.8753	104	2.2742	.7718	62
Integrated-Sequential math	2.0833	.9003	12	2.0000	----	1
Applied math (tech prep)	2.8333	.4082	6	1.5000	.7071	2
Other	2.2121	.7809	33	1.7500	.9574	4
Total valid cases: 1394						

Note. School designations: LEP (Limited English Proficient); FEP (Fluent English Proficient); IFE (Initially Fluent in English). Responses: 1 = not very well; 2 = fairly well; 3 = very well.

Table C36

Total Sample: Means and Standard Deviations of Responses from LEP and FEP/IFE Students to the Question, "How well do you write that language?" (Item 11)

Background variables	LEP			FEP/IFE		
	Mean	SD	N	Mean	SD	N
Full sample	2.0684	.8319	819	2.2227	.8055	220
Gender						
Male	2.0291	.8328	446	2.1731	.8178	104
Female	2.1212	.8255	363	2.2783	.7897	115
Ethnicity						
White (not Hispanic)	2.1600	.8505	25	2.5714	.5071	21
African American (not Hispanic)	1.7500	.8864	8	2.4286	.8516	14
Hispanic	2.2045	.7841	572	2.1579	.7823	114
Asian/Pacific Islander	1.6218	.8374	156	2.2857	.8660	49
American Indian–Alaskan	1.8000	.8367	5	3.0000	----	1
Other	1.8529	.8214	34	2.1333	.8338	15
Kind of math taking this year						
Not taking math	1.8889	.9003	18	2.0000	1.4142	2
8th-grade math	2.1463	.8091	458	2.0000	.8623	79
Pre-algebra	1.8832	.8750	137	2.3846	.7222	65
Algebra	1.9615	.8352	104	2.3871	.7323	62
Integrated-Sequential math	1.7500	.7538	12	2.0000	----	1
Applied math (tech prep)	2.6667	.5164	6	1.5000	.7071	2
Other	2.0303	.8095	33	2.2500	.9574	4
Total valid cases: 1394						

Note. School designations: LEP (Limited English Proficient); FEP (Fluent English Proficient); IFE (Initially Fluent in English). Responses: 1 = not very well; 2 = fairly well; 3 = very well.

Table C37

Total Sample: Means and Standard Deviations of Responses from LEP and FEP/IFE Students to the Question, "How well do you understand spoken English?" (Item 13)

Background variables	LEP			FEP/IFE		
	Mean	SD	N	Mean	SD	N
Full sample	2.3141	.8100	882	1.8540	.9544	459
Gender						
Male	2.3319	.8011	473	1.9375	.9639	240
Female	2.3075	.8183	400	1.7661	.9384	218
Ethnicity						
White (not Hispanic)	2.1379	.9533	29	1.4097	.7970	144
African American (not Hispanic)	2.3750	.8851	16	2.5309	.8527	81
Hispanic	2.2757	.8189	613	1.7869	.8929	122
Asian/Pacific Islander	2.4151	.7573	159	1.6842	.8896	57
American Indian–Alaskan	2.0000	1.000	5	2.2500	1.0351	8
Other	2.5385	.7199	39	2.1613	.9696	31
Kind of math taking this year						
Not taking math	2.6190	.5896	21	2.5000	1.0000	4
8th-grade math	2.3069	.8106	492	2.4891	.8055	137
Pre-algebra	2.4653	.7747	144	1.8267	.9536	150
Algebra	2.1538	.8572	117	1.1549	.4953	142
Integrated-Sequential math	2.1538	.8987	13	1.0000	.0000	3
Applied math (tech prep)	2.0000	.8944	6	3.0000	.0000	2
Other	2.2500	.8062	36	2.7143	.7559	7
Total valid cases: 1394						

Note. School designations: LEP (Limited English Proficient); FEP (Fluent English Proficient); IFE (Initially Fluent in English). Responses: 1 = not very well; 2 = fairly well; 3 = very well.

Table C38

Total Sample: Means and Standard Deviations of Responses from LEP and FEP/IFE Students to the Question, "How well do you speak English?" (Item 14)

Background variables	LEP			FEP/IFE		
	Mean	SD	N	Mean	SD	N
Full sample	2.2792	.8001	881	1.8590	.9393	461
Gender						
Male	2.3017	.7909	474	1.9079	.9482	239
Female	2.2720	.8019	397	1.8100	.9294	221
Ethnicity						
White (not Hispanic)	2.0357	.8812	28	1.4236	.7984	144
African American (not Hispanic)	2.3529	.9315	17	2.5244	.8348	82
Hispanic	2.2598	.8068	612	1.7705	.8794	122
Asian/Pacific Islander	2.3418	.7467	158	1.6552	.8283	58
American Indian–Alaskan	2.4000	.8944	5	2.3750	.9161	8
Other	2.4872	.7564	39	2.2581	.9298	31
Kind of math taking this year						
Not taking math	2.6667	.6583	21	2.5000	1.0000	4
8th-grade math	2.2802	.8029	489	2.4710	.8032	138
Pre-algebra	2.3706	.7569	143	1.8278	.9292	151
Algebra	2.0940	.8406	117	1.1761	.5095	142
Integrated-Sequential math	2.2143	.8018	14	1.0000	.0000	3
Applied math (tech prep)	2.1667	.7528	6	3.0000	.0000	2
Other	2.1351	.7875	37	2.8571	.3780	7
Total valid cases: 1394						

Note. School designations: LEP (Limited English Proficient); FEP (Fluent English Proficient); IFE (Initially Fluent in English). Responses: 1 = not very well; 2 = fairly well; 3 = very well.

Table C39

Total Sample: Means and Standard Deviations of Responses from LEP and FEP/IFE Students to the Question, "How well do you read English?" (Item 15)

Background variables	LEP			FEP/IFE		
	Mean	SD	N	Mean	SD	N
Full sample	2.2534	.7754	880	1.8615	.9116	462
Gender						
Male	2.2716	.7603	475	1.9208	.9090	240
Female	2.2475	.7855	396	1.8009	.9126	221
Ethnicity						
White (not Hispanic)	2.0714	.8133	28	1.4514	.7740	144
African American (not Hispanic)	2.4706	.7174	17	2.5060	.8171	83
Hispanic	2.2226	.7869	611	1.7623	.8238	122
Asian/Pacific Islander	2.3145	.7303	159	1.6897	.8626	58
American Indian–Alaskan	2.6000	.5477	5	2.0000	.9258	8
Other	2.4359	.7180	39	2.2581	.9298	31
Kind of math taking this year						
Not taking math	2.5714	.5976	21	2.5000	1.0000	4
8th-grade math	2.2633	.7794	490	2.4493	.8021	138
Pre-algebra	2.3542	.7430	144	1.8224	.9142	152
Algebra	2.0522	.7818	115	1.2394	.5317	142
Integrated-Sequential math	2.3077	.8549	13	1.0000	.0000	3
Applied math (tech prep)	2.1667	.7528	6	2.5000	.7071	2
Other	2.1351	.7875	37	2.7143	.4880	7
Total valid cases: 1394						

Note. School designations: LEP (Limited English Proficient); FEP (Fluent English Proficient); IFE (Initially Fluent in English). Responses: 1 = not very well; 2 = fairly well; 3 = very well.

Table C40

Total Sample: Means and Standard Deviations of Responses from LEP and FEP/IFE Students to the Question, "How well do you write English?" (Item 16)

	LEP			FEP/IFE		
Background variables	Mean	SD	N	Mean	SD	N
Full sample	2.1719	.7805	884	1.8612	.9078	461
Gender						
Male	2.1642	.7620	475	1.9540	.8993	239
Female	2.1930	.7991	399	1.7647	.9090	221
Ethnicity						
White (not Hispanic)	1.9286	.7164	28	1.4895	.7860	143
African American (not Hispanic)	2.4706	.7174	17	2.5181	.8317	83
Hispanic	2.1319	.7835	614	1.7623	.8337	122
Asian/Pacific Islander	2.3208	.7657	159	1.6207	.8128	58
American Indian–Alaskan	2.0000	.7071	5	2.1250	.9910	8
Other	2.3333	.7375	39	2.1613	.8980	31
Kind of math taking this year						
Not taking math	2.1905	.7496	21	2.2500	.9574	4
8th-grade math	2.1996	.7908	491	2.4203	.7997	138
Pre-algebra	2.3333	.7290	144	1.8355	.9021	152
Algebra	2.0000	.7768	117	1.2411	.5593	141
Integrated-Sequential math	1.9231	.8623	13	1.3333	.5774	3
Applied math (tech prep)	2.0000	.8944	6	2.5000	.7071	2
Other	1.808	.7007	37	2.5714	.7868	7
Total valid cases: 1394						

Note. School designations: LEP (Limited English Proficient); FEP (Fluent English Proficient); IFE (Initially Fluent in English). Responses: 1 = not very well; 2 = fairly well; 3 = very well.

Table C41

Hispanic Sample: Means and Standard Deviations of Responses from LEP and FEP/IFE Students to the Question, "How often do you speak that language with your parents?" (Item 4)

	LEP			FEP/IFE		
Background variables	Mean	SD	N	Mean	SD	N
Full sample	2.4891	.7278	595	1.9587	.8103	121
Gender						
Male	2.5078	.7207	321	2.0536	.8403	56
Female	2.4717	.7335	265	1.8906	.7790	64
Ethnicity						
White (not Hispanic)	2.4118	.8703	17	2.8571	.3780	7
African American (not Hispanic)	1.8571	.6901	7	1.6667	1.1547	3
Hispanic	2.4991	.7245	533	1.8911	.7861	101
Asian/Pacific Islander	3.0000	.0000	2	----	----	----
American Indian–Alaskan	2.5000	.7071	2	----	----	----
Other	2.3684	.7609	19	2.1250	.9910	8
Kind of math taking this year						
Not taking math	2.4167	.6686	12	2.0000	----	1
8th-grade math	2.5349	.7053	372	2.0204	.8289	49
Pre-algebra	2.4342	.7543	76	2.1212	.7809	33
Algebra	2.1186	.8322	59	1.6333	.7649	30
Integrated-Sequential math	2.5000	.7071	10	1.0000	----	1
Applied math (tech prep)	3.0000	.0000	2	2.0000	.0000	2
Other	2.5357	.7445	28	2.5000	.7071	2
Total valid cases: 784						

Note. School designations: LEP (Limited English Proficient); FEP (Fluent English Proficient); IFE (Initially Fluent in English). Responses: 1 = never or hardly ever; 2 = sometimes; 3 = always or most of the time.

Table C42

Hispanic Sample: Means and Standard Deviations of Responses from LEP and FEP/IFE Students to the Question, "How often do you speak that language with your siblings?" (Item 5)

	LEP			FEP/IFE		
Background variables	Mean	SD	N	Mean	SD	N
Full sample	2.2027	.6849	587	2.0339	.7272	118
Gender						
Male	2.1944	.6821	319	2.0893	.7453	56
Female	2.2085	.6897	259	1.9839	.7127	62
Ethnicity						
White (not Hispanic)	2.2778	.7519	18	2.7143	.4880	7
African American (not Hispanic)	1.7143	.7559	7	1.5000	.7071	2
Hispanic	2.1886	.6800	525	2.0202	.7140	99
Asian/Pacific Islander	2.0000	----	1	----	----	----
American Indian–Alaskan	3.0000	.0000	2	----	----	----
Other	2.2632	.7335	19	1.8750	.8345	8
Kind of math taking this year						
Not taking math	2.1538	.8006	13	2.0000	----	1
8th-grade math	2.1913	.6716	366	1.8125	.7339	48
Pre-algebra	2.2973	.6770	74	2.2813	.6832	32
Algebra	2.0690	.6974	58	2.0690	.6509	29
Integrated-Sequential math	2.1000	.7379	10	2.0000	----	1
Applied math (tech prep)	2.5000	.7071	2	1.5000	.7071	2
Other	2.2500	.7005	28	3.000	.0000	2
Total valid cases: 784						

Note. School designations: LEP (Limited English Proficient); FEP (Fluent English Proficient); IFE (Initially Fluent in English). Responses: 1 = never or hardly ever; 2 = sometimes; 3 = always or most of the time.

Table C43

Hispanic Sample: Means and Standard Deviations of Responses from LEP and FEP/IFE Students to the Question, "How often do you speak that language at school?" (Item 6)

	LEP			FEP/IFE		
Background variables	Mean	SD	N	Mean	SD	N
Full sample	2.0756	.6298	595	2.1983	.6003	121
Gender						
Male	2.0872	.6509	321	2.2500	.5800	56
Female	2.0566	.6097	265	2.1719	.6057	64
Ethnicity						
White (not Hispanic)	2.3333	.6304	580	3.0000	.0000	7
African American (not Hispanic)	1.7143	.7559	7	1.6667	.5774	3
Hispanic	2.0714	.6278	532	2.1584	.5955	101
Asian/Pacific Islander	2.0000	.0000	2	----	----	----
American Indian–Alaskan	2.0000	1.4142	2	----	----	----
Other	1.9474	.7050	19	2.2500	.4629	8
Kind of math taking this year						
Not taking math	2.4615	.7763	13	2.0000	----	1
8th-grade math	2.0728	.6347	371	2.0816	.5714	49
Pre-algebra	1.9868	.5999	76	2.2727	.6742	33
Algebra	2.0339	.5862	59	2.2667	.5208	30
Integrated-Sequential math	2.2000	.7888	10	3.0000	----	1
Applied math (tech prep)	2.5000	.7071	2	2.5000	.7071	2
Other	2.0714	.6627	28	2.0000	1.4142	2
Total valid cases: 784						

Note. School designations: LEP (Limited English Proficient); FEP (Fluent English Proficient); IFE (Initially Fluent in English). Responses: 1 = never or hardly ever; 2 = sometimes; 3 = always or most of the time.

Table C44

Hispanic Sample: Means and Standard Deviations of Responses from LEP and FEP/IFE Students to the Question, "How often do you speak that language outside school?" (Item 7)

	LEP			FEP/IFE		
Background variables	Mean	SD	N	Mean	SD	N
Full sample	2.0773	.6571	595	2.0917	.6610	120
Gender						
Male	2.0872	.6791	321	2.0714	.6283	56
Female	2.0566	.6341	265	2.1270	.6837	63
Ethnicity						
White (not Hispanic)	2.2222	.5483	18	3.0000	.0000	7
African American (not Hispanic)	1.5714	.7868	7	2.0000	.0000	2
Hispanic	2.0827	.6558	532	2.0297	.6396	101
Asian/Pacific Islander	2.0000	.0000	2	----	----	----
American Indian–Alaskan	2.0000	1.4142	2	----	----	----
Other	1.8421	.6882	19	2.1250	.6409	8
Kind of math taking this year						
Not taking math	2.0769	.8623	13	1.0000	----	1
8th-grade math	2.0943	.6570	371	2.0408	.6757	49
Pre-algebra	2.0263	.6527	76	2.1875	.7378	32
Algebra	1.9831	.6295	59	2.1000	.5477	30
Integrated-Sequential math	2.1000	.8756	10	2.0000	----	1
Applied math (tech prep)	3.0000	.0000	2	2.0000	.0000	2
Other	2.0357	.5762	28	2.5000	.7071	2
Total valid cases: 784						

Note. School designations: LEP (Limited English Proficient); FEP (Fluent English Proficient); IFE (Initially Fluent in English). Responses: 1 = never or hardly ever; 2 = sometimes; 3 = always or most of the time.

Table C45

Hispanic Sample: Means and Standard Deviations of Responses from LEP and FEP/IFE Students to the Question, "How well do you speak that language?" (Item 8)

Background variables	LEP			FEP/IFE		
	Mean	SD	N	Mean	SD	N
Full sample	2.3564	.7447	592	1.9083	.7447	121
Gender						
Male	2.3511	.7496	319	1.9286	.7594	56
Female	2.3750	.7293	264	1.9048	.7343	63
Ethnicity						
White (not Hispanic)	2.4444	.7838	18	2.4286	.5345	7
African American (not Hispanic)	1.5714	.7868	7	2.0000	.0000	2
Hispanic	2.3629	.7415	529	1.8515	.7535	101
Asian/Pacific Islander	1.5000	.7071	2	----	----	----
American Indian–Alaskan	2.5000	.7071	2	----	----	----
Other	2.5263	.5130	19	2.1250	.8345	8
Kind of math taking this year						
Not taking math	2.5385	.6602	13	2.0000	----	1
8th-grade math	2.3641	.7330	368	1.9796	.7770	49
Pre-algebra	2.3289	.7003	76	2.0625	.7156	32
Algebra	2.2203	.8523	59	1.6333	.6687	30
Integrated-Sequential math	2.2000	.7888	10	1.0000	----	1
Applied math (tech prep)	3.0000	.0000	2	1.5000	.7071	2
Other	2.3929	.7860	28	2.5000	.7071	2
Total valid cases: 784						

Note. School designations: LEP (Limited English Proficient); FEP (Fluent English Proficient); IFE (Initially Fluent in English). Responses: 1 = not very well; 2 = fairly well; 3 = very well.

Table C46

Hispanic Sample: Means and Standard Deviations of Responses from LEP and FEP/IFE Students to the Question, "How well do you understand that language?" (Item 9)

	LEP			FEP/IFE		
Background variables	Mean	SD	N	Mean	SD	N
Full sample	2.4401	.7399	593	1.9504	.8047	121
Gender						
Male	2.4455	.7359	321	2.0000	.8312	56
Female	2.4432	.7378	264	1.9219	.7828	64
Ethnicity						
White (not Hispanic)	2.4444	.7838	18	2.2857	.4880	7
African American (not Hispanic)	1.7143	.9512	7	2.0000	.0000	3
Hispanic	2.4501	.7364	531	1.9010	.8307	101
Asian/Pacific Islander	1.5000	.7071	2	----	----	----
American Indian–Alaskan	3.0000	.0000	2	----	----	----
Other	2.5263	.6118	19	2.1250	.8345	8
Kind of math taking this year						
Not taking math	2.6923	.6304	13	2.0000	----	1
8th-grade math	2.4582	.7206	371	2.1224	.8325	49
Pre-algebra	2.3553	.7608	76	1.9394	.7044	33
Algebra	2.2203	.8919	59	1.5333	.6814	30
Integrated-Sequential math	2.3000	.8233	10	1.0000	----	1
Applied math (tech prep)	2.5000	.7071	2	3.0000	.0000	2
Other	2.5556	.6980	27	3.0000	.0000	2
Total valid cases: 784						

Note. School designations: LEP (Limited English Proficient); FEP (Fluent English Proficient); IFE (Initially Fluent in English). Responses: 1 = not very well; 2 = fairly well; 3 = very well.

Table C47

Hispanic Sample: Means and Standard Deviations of Responses from LEP and FEP/IFE Students to the Question, "How well do you read that language?" (Item 10)

Background variables	LEP			FEP/IFE		
	Mean	SD	N	Mean	SD	N
Full sample	2.1771	.7953	593	2.0583	.7702	120
Gender						
Male	2.1344	.7982	320	1.9821	.7505	56
Female	2.2340	.7870	265	2.1429	.7799	63
Ethnicity						
White (not Hispanic)	2.3333	.9075	18	2.7143	.4880	7
African American (not Hispanic)	2.0000	1.0000	7	1.0000	.0000	2
Hispanic	2.1695	.7900	531	2.0396	.7605	101
Asian/Pacific Islander	2.0000	1.4142	2	----	----	----
American Indian–Alaskan	2.0000	1.4142	2	----	----	----
Other	2.1579	.7647	19	2.2500	.7071	8
Kind of math taking this year						
Not taking math	2.0000	.8165	13	1.0000	----	1
8th-grade math	2.1838	.7921	370	1.9388	.7748	49
Pre-algebra	2.1316	.7719	76	2.3750	.7513	32
Algebra	2.0508	.8793	59	2.0333	.7184	30
Integrated-Sequential math	2.1000	.8756	10	2.0000	----	1
Applied math (tech prep)	2.5000	.7071	2	1.5000	.7071	2
Other	2.3214	.7228	28	1.5000	.7071	2
Total valid cases: 784						

Note. School designations: LEP (Limited English Proficient); FEP (Fluent English Proficient); IFE (Initially Fluent in English). Responses: 1 = not very well; 2 = fairly well; 3 = very well.

Table C48

Hispanic Sample: Means and Standard Deviations of Responses from LEP and FEP/IFE Students to the Question, "How well do you write that language?" (Item 11)

Background variables	LEP			FEP/IFE		
	Mean	SD	N	Mean	SD	N
Full sample	2.1912	.7826	591	2.1500	.7741	120
Gender						
Male	2.1604	.7839	318	2.1250	.7643	56
Female	2.2377	.7737	265	2.1905	.7799	63
Ethnicity						
White (not Hispanic)	2.3889	.7775	18	2.8571	.3780	7
African American (not Hispanic)	1.5714	.7868	7	1.0000	.0000	2
Hispanic	2.1943	.7814	530	2.1485	.7535	101
Asian/Pacific Islander	1.5000	.7071	2	----	----	----
American Indian–Alaskan	1.5000	.7071	2	----	----	----
Other	2.2222	.7321	18	2.1250	.8345	8
Kind of math taking this year						
Not taking math	1.9231	.8623	13	1.0000	----	1
8th-grade math	2.2087	.7783	369	1.9184	.8123	49
Pre-algebra	2.1974	.7835	76	2.5313	.5671	32
Algebra	2.0847	.8155	59	2.2000	.7611	30
Integrated-Sequential math	1.9000	.7379	10	2.0000	----	1
Applied math (tech prep)	2.5000	.7071	2	1.5000	.7071	2
Other	2.1071	.7860	28	2.5000	.7071	2
Total valid cases: 784						

Note. School designations: LEP (Limited English Proficient); FEP (Fluent English Proficient); IFE (Initially Fluent in English). Responses: 1 = not very well; 2 = fairly well; 3 = very well.

Table C49

Hispanic Sample: Means and Standard Deviations of Responses from LEP and FEP/IFE Students to the Question, "How well do you understand that language?" (Item 13)

Background variables	LEP			FEP/IFE		
	Mean	SD	N	Mean	SD	N
Full sample	2.3664	.7856	625	1.7302	.9070	120
Gender						
Male	2.3515	.7859	330	1.8103	.9072	58
Female	2.4063	.7774	288	1.6716	.9110	67
Ethnicity						
White (not Hispanic)	2.5000	.8575	18	1.0000	.0000	7
African American (not Hispanic)	1.7143	.9512	7	3.0000	.0000	3
Hispanic	2.3559	.7863	562	1.7264	.9001	106
Asian/Pacific Islander	2.5000	.7071	2	----	----	----
American Indian–Alaskan	2.0000	1.4142	2	----	----	----
Other	2.6842	.5824	19	1.6250	.9161	8
Kind of math taking this year						
Not taking math	2.5625	.6292	16	3.0000	----	1
8th-grade math	2.3814	.7768	388	2.1765	.9101	57
Pre-algebra	2.4416	.8028	77	1.4706	.7876	34
Algebra	2.2388	.8365	67	1.1250	.4212	32
Integrated-Sequential math	2.0909	.9439	11	1.0000	----	1
Applied math (tech prep)	2.0000	.0000	2	3.0000	.0000	2
Other	2.3214	.7724	28	3.0000	.0000	2
Total valid cases: 784						

Note. School designations: LEP (Limited English Proficient); FEP (Fluent English Proficient); IFE (Initially Fluent in English). Responses: 1 = not very well; 2 = fairly well; 3 = very well.

Table C50

Hispanic Sample: Means and Standard Deviations of Responses from LEP and FEP/IFE Students to the Question, "How well do you speak English?" (Item 14)

Background variables	LEP			FEP/IFE		
	Mean	SD	N	Mean	SD	N
Full sample	2.3349	.7717	624	1.7381	.8960	126
Gender						
Male	2.3323	.7656	331	1.7586	.8848	58
Female	2.3671	.7642	286	1.7313	.9142	67
Ethnicity						
White (not Hispanic)	2.2222	.8085	18	1.0000	.0000	7
African American (not Hispanic)	1.7143	.9512	7	3.0000	.0000	3
Hispanic	2.3387	.7696	561	1.7170	.8811	106
Asian/Pacific Islander	2.5000	.7071	2	----	----	----
American Indian–Alaskan	2.0000	1.4142	2	----	----	----
Other	2.5189	.6070	19	1.8750	.9910	8
Kind of math taking this year						
Not taking math	2.6875	.6021	16	3.0000	----	1
8th-grade math	2.3472	.7653	386	2.1961	.8949	51
Pre-algebra	2.3896	.7636	77	1.4706	.7876	34
Algebra	2.1493	.8212	67	1.1563	.4479	32
Integrated-Sequential math	2.3636	.8090	11	1.0000	----	1
Applied math (tech prep)	2.5000	.7071	2	3.0000	.0000	2
Other	2.2069	.7260	29	2.5000	.7071	2
Total valid cases: 784						

Note. School designations: LEP (Limited English Proficient); FEP (Fluent English Proficient); IFE (Initially Fluent in English). Responses: 1 = not very well; 2 = fairly well; 3 = very well.

Table C51

Hispanic Sample: Means and Standard Deviations of Responses from LEP and FEP/IFE Students to the Question, "How well do you read English?" (Item 15)

	LEP			FEP/IFE		
Background variables	Mean	SD	N	Mean	SD	N
Full sample	2.3002	.7553	623	1.7222	.8451	126
Gender						
Male	2.3082	.7438	331	1.6724	.7811	58
Female	2.3193	.7551	285	1.7761	.9015	67
Ethnicity						
White (not Hispanic)	2.2222	.8085	18	1.0000	.0000	7
African American (not Hispanic)	2.1429	.8997	7	3.0000	.0000	3
Hispanic	2.3000	.7538	560	1.7264	.8227	106
Asian/Pacific Islander	2.5000	.7071	2	----	----	----
American Indian–Alaskan	2.5000	.7071	2	----	----	----
Other	2.4737	.6967	19	1.7500	1.0351	8
Kind of math taking this year						
Not taking math	2.5000	.6325	16	1.0000	----	1
8th-grade math	2.3230	.7491	387	2.2157	.8789	51
Pre-algebra	2.3636	.7418	77	1.4412	.7046	34
Algebra	2.1385	.7881	65	1.2188	.4908	32
Integrated-Sequential math	2.2727	.9045	11	1.0000	----	1
Applied math (tech prep)	2.5000	.7071	2	2.5000	.7071	2
Other	2.2069	.7736	29	2.0000	.0000	2
Total valid cases: 784						

Note. School designations: LEP (Limited English Proficient); FEP (Fluent English Proficient); IFE (Initially Fluent in English). Responses: 1 = not very well; 2 = fairly well; 3 = very well.

Table C52

Hispanic Sample: Means and Standard Deviations of Responses from LEP and FEP/IFE Students to the Question, "How well do you write English?" (Item 16)

	LEP			FEP/IFE		
Background variables	Mean	SD	N	Mean	SD	N
Full sample	2.2026	.7491	627	1.6746	.8083	126
Gender						
Male	2.1873	.7352	331	1.7241	.8120	58
Female	2.2396	.7570	288	1.6418	.8109	67
Ethnicity						
White (not Hispanic)	2.0506	.6391	18	1.0000	.0000	7
African American (not Hispanic)	2.1429	.8997	7	3.0000	.0000	3
Hispanic	2.2078	.7530	563	1.6981	.8068	106
Asian/Pacific Islander	2.5000	.7071	2	----	----	----
American Indian–Alaskan	2.0000	.0000	2	----	----	----
Other	2.3684	.6840	19	1.3750	.5175	8
Kind of math taking this year						
Not taking math	2.1250	.7188	16	1.0000	----	1
8th-grade math	2.2526	.7561	388	2.0784	.8448	51
Pre-algebra	2.3377	.7184	77	1.4412	.7046	32
Algebra	2.0448	.7268	67	1.2813	.5811	32
Integrated-Sequential math	2.0000	.8944	11	1.0000	----	1
Applied math (tech prep)	2.0000	1.4142	2	2.5000	.7071	2
Other	1.8276	.6584	29	1.5000	.7071	2
Total valid cases: 784						

Note. School designations: LEP (Limited English Proficient); FEP (Fluent English Proficient); IFE (Initially Fluent in English). Responses: 1 = not very well; 2 = fairly well; 3 = very well.