



Research-Based Strategies for Teaching Social Studies, Science, and Mathematics to ELs at the Secondary Level

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Introduction

According to Aud et al. (2011), over the past two decades there has been an increase from 4.7 million to 11.2 million school-aged children who speak a language other than English in their homes. The current figure represents over 20% of the population between 5 and 17 years of age.

Educating English learners (ELs) at the secondary level presents particular challenges for the students, their teachers, and the schools that serve them—about 47% of the ELs are in secondary schools (Capps, Fix, Murray, et al., 2005). Research on successful strategies for ELs in general is scarce, and it is even more limited for secondary-level strategies (August & Hakuta, 1997; August & Shanahan, 2006).

There are multiple definitions of EL strategies (Merrill, 2007). For the purpose of this briefing paper, a strategy is defined as change in instruction effected to facilitate meaningful content delivery for ELs as a group. For further clarification, both strategies and accommodations involve change in the delivery or instruction of the content, but not in the curriculum itself. The difference between the two is the target: a strategy targets a group of students, as a whole, while an accommodation targets a single student, based on his or her specific needs. A modification, on the other hand, is a change in the curriculum or content of instruction. The focus of this paper is on instructional strategies designed to facilitate meaningful content delivery for groups of EL secondary students in social studies, science, and mathematics.

Instructional strategies for ELs involve three ways of changing content delivery to address their learning demands:

- 1) Access to the content in multiple ways, such as using images, videos, gestures, and other visuals to convey meaning (given that meaning is embedded in a linguistic message to which ELs have limited access)
- 2) Facilitation of the English language or language of instruction (e.g., modeling clear enunciation, establishing language routines, repeating the student's answers in classroom-appropriate speech, allowing the student more time to answer)
- 3) Teaching of the academic language necessary to understand the content (One common practice is to give Spanish speakers the opportunity to identify cognates and to make connections to their English meaning. Spanish/English cognates make up 88% of the science vocabulary, and those are high-frequency words in Spanish.)

(Welch-Ross, 2010)

Summary

It is difficult for secondary-level ELs to achieve academic success comparable to their non-EL peers because of linguistic challenges specific to secondary-level core-content areas, in addition to barriers faced by ELs in general. Some promising strategies for use in mathematics, science, and social studies are reported.

Key Points

- ELs in secondary schools face challenges different from those in elementary schools.
- Explicit teaching of cognitive strategies has shown benefits for secondary ELs.
- Teachers need to use multiple ways of presenting information to support learning for secondary ELs.



This article is intended to provide useful, research-based information for those seeking to support ELs at the secondary level in social studies, science, and mathematics. It may also prove helpful for those who would like to be informed of factors related to the educational achievement of this significant and growing number of students. The authors also provide some general strategies used in English as a Second Language (ESL) programs to demonstrate the distinction between ESL and content needs of ELs.

Search Method

To obtain information needed for this paper, multiple searches were conducted; resources were evaluated for relevance to the educational outcomes of students in the focal content areas. Only studies that looked specifically at achievement outcomes were considered—studies that focused on other factors, such as motivation and participation, were not included. Due to the scarcity of research on the specific topic, the initial search parameters were broadened in an attempt to locate additional material. Search findings were supplemented with two studies recently presented at the 2011 Center for Research on the Educational Achievement and Teaching of English Language Learners (CREATE) conference.

Texas Comprehensive Center (TXCC) staff conducted a literature search for research reports evaluating the effectiveness of specific strategies that improve achievement outcomes of ELs at the secondary level in three content areas: mathematics, science, and social studies. Bibliographic databases for the field of education—EBSCO and ERIC—were used, and search results were constrained by the time frame of 2000–2012, unless seminal works from earlier dates were identified. Search terms included “strategy” or “strategies,” combined with “teaching,” “learning,” and “instruction,” as well as the academic content areas (mathematics, science, and social studies). Results were narrowed by combining with a variety of terms and acronyms typically used to refer to English learners: English learner (EL), English language learner (ELL), limited English proficient (LEP), English as a Second Language (ESL), bilingual students, and language minority students. As recommended by the Elementary and Secondary Education Act (ESEA), preferences for publication types were ranked as 1) meta analyses, 2) systematic literature reviews, 3) research reports of studies using experimental design, 4) research reports of studies using other designs, and 5) case studies.

Five articles retrieved were of marginal relevance: two of them focused on the evaluation measures for strategies rather than the effectiveness of the strategies themselves; two focused on reading strategies and not directly on content-area outcomes (educational achievement). The fifth one discussed an ESL program, which encompasses several strategies, but its main focus was a program certification. Several case studies were found, but they were about learning by teachers and not necessarily about using any specific strategy. Only one article (Olson & Land, 2007) was located that focused directly on evaluating strategies of a program targeting the EL population and met the criteria for research-based resources. Although the strategies evaluated in this study were not for science, math, or social studies specifically, it is included here because it examined a general cognitive strategy that impacted outcomes related to science and social studies. The outcome measures included academic writing and reading across disciplines, which are highly related to achievement in all content areas (Fillmore & Snow, 2002).

Additional search terms were added to expand the original search: scaling, modification, and differentiated instruction. Staff used these additional terms because researchers often use them interchangeably with strategies (see differentiation among strategy, accommodation, and modification in earlier paragraph). Also, staff searched the Education Full Text database using its controlled vocabulary term, “English language – Study & teaching – Foreign speakers” and the keyword, “secondary,” limited to science, mathematics, and social studies. Although several papers retrieved through these searches looked promising, further examination revealed they did not fit within the criteria established for this brief. Among reasons for exclusion were the following: 1) not research based, 2) not focused on strategies, 3) not focused on secondary level students, or 4) not focused on content-area outcomes.

Given the scarcity of appropriate resources located by the literature searches, TXCC staff expanded the parameters for relevant materials and looked for projects or grants that are targeting this specific population. One current research project, at CREATE, is examining the needs of ELs in grades 4–8 in science and social studies. A CREATE conference was held in Austin, Texas on November 3–4, 2011, to share the preliminary results of its studies. Two studies are discussed in this report.



Limitations

A major limitation of this report is that very little research was found on the topic of interest. Many studies of ELs are conducted at the program level (e.g., bilingual, dual-language). However, most of the strategies at the program level cannot be implemented in secondary schools because of the peripatetic scheduling of classes (i.e., students move from room to room and teacher to teacher for each class).

There are also general strategies and programs that are often used to facilitate the instruction for ELs, such as hands-on instruction, SIOP (Sheltered Instruction Observation Protocol) methods, and others. Evaluations of these instructional methods are holistic; that is, they do not look at the effect of a specific strategy on the target population. For example, SIOP evaluations focus on the teacher and fidelity of implementation of the program, not on student outcomes.

Although expanding the criteria or the topic of research should have provided more resources, the scarcity of the findings—in itself—is significant and points to the need for additional research around support for secondary ELs in the content areas. Given the limitation of published materials, the authors of this paper included reports provided at a 2011 CREATE conference. The conference presentations have not yet been published, but they included preliminary data from current studies on ELs at the secondary level. The authors/presenters (see listing in section titled, The CREATE Studies) of the studies are considered by those in the field to be some of the leading researchers on working with ELs.

Background

In 1964, the U.S. Congress passed the Civil Rights Act (Public Law 82-352), which encouraged desegregation of public schools, in addition to banning discrimination—based on race, color, religion, sex, or national origin—in the workplace. Three years later Texas Senator Ralph Yarborough introduced a bill to provide assistance for school districts to develop programs to help students with limited English speaking ability (LESA). This bill focused only on Spanish-speaking students; however, it was broadened through merging with 37 other bills and became a statute under Title VII of the Elementary and Secondary Education Amendment of 1967 (Leibowitz, 1980). Title VII was known as the Bilingual Education Act (BEA), and it provided for federal competitive grants to school districts to establish innovative educational programs for LESA students. However, under BEA there were few guidelines for the programs, and participation by districts was voluntary (Stewner-Manzanares, 1988).

Amendments to BEA were prompted by the *Lau v. Nichols* case and the Equal Education Opportunity Act of 1974 (Stewner-Manzanares, 1988). In *Lau v. Nichols* (1974), the U.S. Supreme Court ruled that the San Francisco school system failed to provide English language instruction to students of Chinese ancestry or to provide them with other linguistically appropriate instruction. The court held that this violated the Civil Rights Act of 1964 by denying the students “a meaningful opportunity to participate in the public educational program.” The Equal Education Opportunity Act specifically stated that districts must take action to “overcome language barriers” in the education of students learning English.

In the 1974 BEA amendments, a bilingual education program was defined as one that provided instruction in a student’s native language, as well as English. The amendments also specified program goals, provided for capacity-building efforts, and required establishment of regional support centers (Stewner-Manzanares, 1988). BEA was further amended in 1978, 1984, and 1988 and was reauthorized in 1994. The Elementary and Secondary Education Act of 2001 (No Child Left Behind Act) subsumed BEA into Title III as the English Language Acquisition, Language Enhancement, and Academic Achievement Act.

Under the various iterations of the BEA, specific instructional practices were not prescribed, but the reauthorization in 1994 provided guidelines for grant applications targeting LESA students. The act allowed local education agencies to create programs based on the goals of the legislation; federal policy provided guidance on appropriate practices that could be included in the programs (Wiese & García, 1998). The programs could meet the U.S. Department of Education’s requirements in a number of ways. These included the following:

- Lessening the linguistic demands of the content (e.g., using visuals such as diagrams or pictures to convey meaning and relationships within information)
- Providing linguistic support to access content (e.g., giving students the opportunity to discuss content in their home-language and work in linguistically diverse groups to construct an answer or presentation)
- Providing language teaching that bridges understanding of instruction (i.e., establishing linguistic routines that facilitate understanding of academic demands, such as writing the big-picture question on the board every day or building a safe system for ELs and other students to ask for language definitions and clarifications)



Table 1 lists the instructional programs that were approved by the U.S. Department of Education as linguistically appropriate to serve ELs (U.S. Department of Education, 2011). The descriptions are from the National Clearinghouse for English Language Acquisition & Language Instruction Educational Programs (2001). The table also lists some of the goals and implications for implementation that are associated with each program type. The highlighted cells indicate programs that are more appropriate for secondary education; non-highlighted programs work for elementary schools, but not at the secondary level. (This distinction is based on professional knowledge and experience of the TXCC staff.) For example, many of the bilingual programs used in elementary schools provide content instruction in the native language simultaneously or sequentially paired with English as a Second Language (ESL) instruction. In Texas Bilingual Education policy (Chapter 89.1205) the requirement is that a bilingual teacher must be provided if there are at least 20 students at the same grade level district-wide who speak the same language; if that situation exists, then the school must make every possible effort to provide content instruction in that language. It would be very difficult in secondary schools to provide a bilingual teacher for every subject, and for that reason secondary schools often provide linguistic accommodation in English classes, in addition to ESL services out of the classrooms. The primary goal of this review is to find strategies that work at the secondary level in the areas of mathematics, social studies, and science. However, the list of programs in Table 1 indicates the different support that should be available to ELs at both the elementary and secondary level.

Table 1. School programs approved by the U.S. Department of Education as linguistically appropriate instruction for ELs. The descriptions of the programs are from National Clearinghouse for English Language Acquisition & Language Instruction Educational Programs (NCELA) Glossary of Terms; available at <http://www.ncela.gwu.edu/rcd/bibliography/BE021775>.

Green shaded cells indicate programs that can be implemented at the secondary level (see explanation under “Background.”)

* The programs marked with an asterisk are most likely to be available at the secondary level. These programs were approved by the U.S. Department of Education as acceptable accommodations (not strategies) for ELs.

School programs approved by the U.S. Department of Education as linguistically appropriate instruction for ELs		
Type of Program	Description	Goal
*Sheltered English instruction	An instructional approach used to make academic instruction in English understandable to English language learners to help them acquire proficiency in English while at the same time achieving in content areas. Sheltered English instruction differs from ESL in that English is not taught as a language with a focus on learning the language. Rather, content knowledge and skills are the goals. In the sheltered classroom, teachers use simplified language, physical activities, visual aids, and the environment to teach vocabulary for concept development in mathematics, science, social studies and other subjects.	To ameliorate the loss of access to content because of linguistically taxed content. It is ideal for schools that do not have enough ELs with the same home-language, trained bilingual teachers, or/and in secondary.
*Structured English immersion	In this program, language minority students receive all of their subject matter instruction in their second language. The teacher uses a simplified form of the second language. Students may use their native language in class; however, the teacher uses only the second language. The goal is to help minority language students acquire proficiency in English while at the same time achieving in content areas.	To develop fluency in English, with only LEP students in the class. All instruction is in English, adjusted to the proficiency level of students so subject matter is comprehensible. Teachers need receptive (comprehension) skill in students’ L1 and sheltered instructional techniques. More than a program, this is a strategy to lessen the demands of English and strategically plan the context in which English is being learned.
*Specially designed academic instruction in English (SDAIE)	Designing instruction using materials and reading on the first language or contextualized in the home-culture but doing all of the teaching in English. Students from various linguistic and cultural backgrounds can be in the same class. Instruction is adapted to students’ proficiency level and supplemented by gestures and visual aids. May be used with other methods; e.g., early exit may use L1 for some classes and SDAIE for others.	To provide LEP students with access to the curriculum. This is a combination of strategies that has been offered as a special certification. It operates under the assumption that language is part of culture, thus, this program plans the language acquisition as part of learning about culture and fostering a bicultural identity. Teachers need to have some knowledge of students’ L1 and culture.



School programs approved by the U.S. Department of Education as linguistically appropriate instruction for ELs (continued)

Type of Program	Description	Goal
*Pull-out ESL	A program in which LEP students are "pulled out" of regular, mainstream classrooms for special instruction in English as a Second Language. This is a common type of service across secondary schools. It is feasible because the content teachers are not involved and the student is learning English with a specialized teacher.	To develop fluency in English It is difficult to assess what the outcomes are because each ESL teacher could use different curriculum and there is no connection to the classroom work. In that sense it is more like EFL setting.
Dual language (Most common for Spanish and English)	These programs are designed to serve both language minority and language majority students concurrently. Two language groups are put together and instruction is delivered through both languages. For example, in the US, native English speakers might learn Spanish as a foreign language while continuing to develop their English literacy skills and Spanish-speaking ELs learn English while developing literacy in Spanish.	To build bilingualism and biliteracy in both groups. It is highly desirable as most nations are multilingual, and bilingualism improves cognitive skills for learning. Also, cost effective and politically appealing, as both English and Spanish speakers have an equal opportunity to become bilingual. Successful implementation requires high commitment from schools and community.
Two-way immersion	Two-way immersion is an educational model that integrates native English speakers and native speakers of another language for all or most of the day. Language learning takes place primarily through content instruction. Academic subjects are taught to all students through both English and the non-English language. As students and teachers work together to perform academic tasks, the students' language abilities are developed, along with their knowledge of content area subject matter.	To promote high academic achievement, first- and second-language development, and cross-cultural understanding for all students. Makes the simultaneous facilitation of content learning and language learning less difficult for teachers, because different teachers teach in the different languages. Successful implementation requires high commitment from schools and community.
Transitional bilingual	Transitional bilingual education (TBE) is an instructional program in which subjects are taught through two languages sequentially—in the native language and then in English—and English is taught as a second language from the beginning. English language skills, grade promotion, and graduation requirements are emphasized, and L1 is used as a tool to learn content. As proficiency in English increases, instruction through L1 decreases. TBE programs vary in the amount of native language instruction provided and the duration of the program. TBE programs may be early-exit or late-exit, depending on the amount of time a child may spend in the program.	To facilitate the limited English proficient (LEP) student's transition to an all-English instructional environment while receiving academic subject instruction in the native language to the extent necessary. Instruction in the native language is required in primary schools with 20 or more speakers of the same second language at the same grade level. It is difficult to implement in areas where there are no trained bilingual teachers and in schools that do not have at least 20 students who speak the same home language at the same grade level.
Developmental bilingual	Instruction at lower grades is in L1, gradually transitioning to English; students typically transition into mainstream classrooms with their English-speaking peers. Differences among this and late transitional and maintenance programs focuses on the degree of literacy students develop in the native language.	To build bilingualism and biliteracy. See also late-exit bilingual education. Best for situations where there are resources available to support the first and second language biliteracy and ideal for nurturing bilingualism.
Heritage language	Heritage language programs typically target students who are non-English speakers or who have weak literacy skills in L1; indigenous language programs support endangered minority language in which students may have weak receptive and no productive skills. Both programs often serve American Indian students.	To build literacy in two languages. Ideal for home-language maintenance and for developing bilingualism. Sometimes accompanied by instruction on history and culture of the home-language. Ideal for fostering diversity and a bicultural identity.
*Push-in ESL	In contrast with pull-out ESL instruction, in push-in ESL, the ESL teacher provides instruction by going into the regular classroom. The push-in services are similar to the pull-out services in that the assumption is that learning the English language is separated from learning the content. However, in the push-in service the teacher comes into the classroom, so the teaching of English is through the teaching of content.	The Push-in services are similar to the pull-out services in that the assumption is that learning the English language is separated from learning the content. However, in the push-in service the teacher comes into the classroom, so the teaching of English is through the teaching of content. This strategy is feasible for secondary schools, but it requires resources of a teacher per class or per student, thus it is rarely observed at that level. Sometimes instead of using a certified teacher schools hire paraprofessionals who speak the same language as the students, these are not certified teachers, but with the guidance of a teacher they could help the learning of the content.



Secondary versus Elementary

Compared to ELs who enter school during early childhood, older children must overcome three additional disadvantages. First, it is less likely that they will have access to bilingual or dual-language instruction because these programs are not readily available in secondary schools. Table 2 lists the types of programs available in each of the states served by the TXCC and the Southeast Comprehensive Center (SECC). Fewer than half of the programs are available at the secondary level, noted as shaded cells, which is another indication of limited support available to secondary level ELs.

Table 2. Number of ELs and types of program available to ELs and in each of the states served by the TXCC and SECC.

Green shaded cells indicate programs applicable at the secondary level.

[Numbers include newly enrolled or recent arrivals to the U.S. and continually enrolled Limited English Proficiency (LEP) students, whether or not they receive services in a Title III language instruction educational program (U. S. Department of Education, 2011).]

Number of ELs and types of program available to ELs and in each of the states served by the TXCC and SECC						
Type of Program	AL 20,674 ELs	GA 85,410 ELs	LA 13,093 ELs	MS 6,084 ELs	SC 31,511 ELs	TX 726,823 ELs
*Sheltered English instruction	Yes	Yes	Yes	Yes	Yes	Yes
*Structured English immersion	Yes	Yes	Yes	Yes	Yes	n.a.
*Specially designed academic instruction in English (SDAIE)	Yes	Yes	Yes	Yes	Yes	n.a.
*Content-based ESL	Yes	Yes	Yes	Yes	Yes	Yes
*Pull-out ESL	Yes	Yes	Yes	Yes	Yes	Yes
Push-in ESL	No	Yes	Yes-with paraprofessional	Yes	No	n.a.
Dual language	No	Yes	Yes	Yes	Yes	Yes
Two-way immersion	No	No	No	Yes	No	Yes
Transitional bilingual	No	No	No	Yes	No	Yes
Developmental bilingual	No	No	No	Yes	No	n.a.
Heritage language	No	Yes	No	No	No	n.a.

The second disadvantage is that students in secondary school also have less time to attain proficiency in English and master the academic content, which is demanding at this level and is highly dependent on linguistic skills (Fillmore & Snow, 2002; Scarcella, 2002). For ELs, the complexity of academic English is a major obstacle as they struggle to develop higher-level English reading and writing skills and simultaneously keep up with the more advanced content (Scarcella). It takes approximately six to ten years for ELs to acquire grade-appropriate reading and writing proficiency in English (Hakuta, Goto-Butler, & Witt, 2000). When ELs enter U.S. schools at the secondary level, however, they do not have even six years to achieve grade-appropriate English proficiency.

A third—and closely related—disadvantage faced by these students is that they have a limited span of time to fulfill formal requirements (e.g., taking and passing exit exams and college admission exams), acquire credits needed for graduation, and prepare academically for postsecondary education. Most native speakers typically have no more than four years to meet these requirements; ELs have this time abbreviated due to the amount of time they must spend learning the English language prior to taking required tests and preparing for college. Unfortunately, the unique needs of ELs at secondary schools are often overlooked, and little or no accommodations are provided when they take the tests. Therefore, after only a brief period of attending U.S. schools, these students must take the same achievement exams as proficient English speakers do.

More than 20 states in the U.S. have established high-stakes exams that require high-level reading and writing abilities across content areas. Fillmore & Snow (2002) studied the linguistic demands of standardized tests by looking at prototype test items for high school exit exams across the nation in all content areas presently tested. This study revealed a high level of academic literacy



that is expected of all secondary students. This, of course, includes ELs, most of whom are not receiving instruction on these linguistically demanding skills:

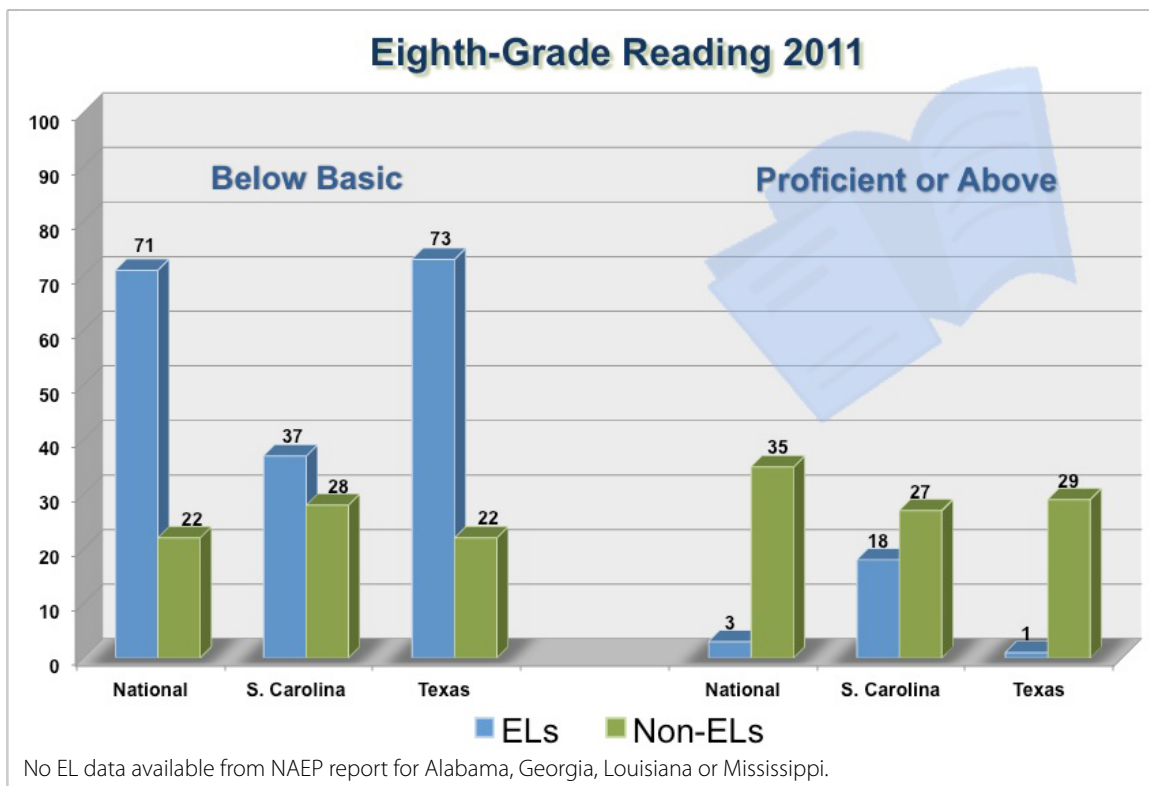
- summarization of complex text
- use of linguistic cues to understand a writer’s intentions and messages
- rhetorical and aesthetic assessment of written text
- evaluation of evidence in support of statements and the logic of arguments made in a text
- development of extended and reasoned texts with supporting evidence and details

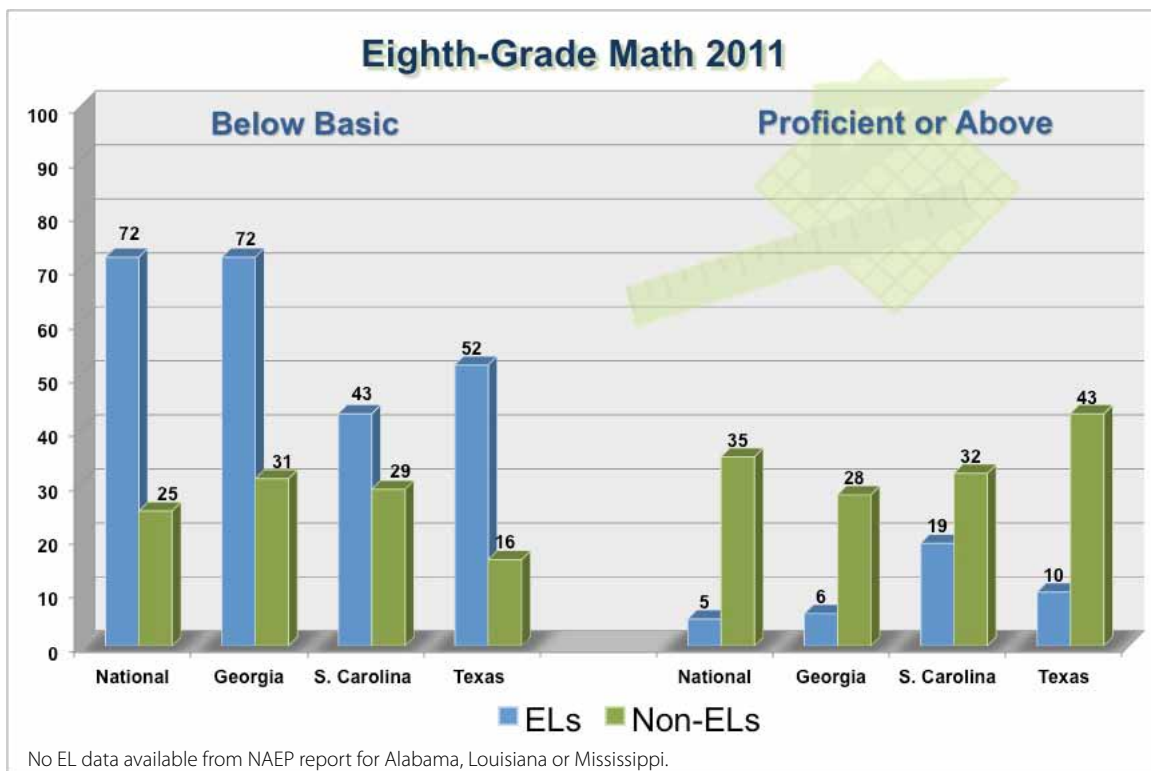
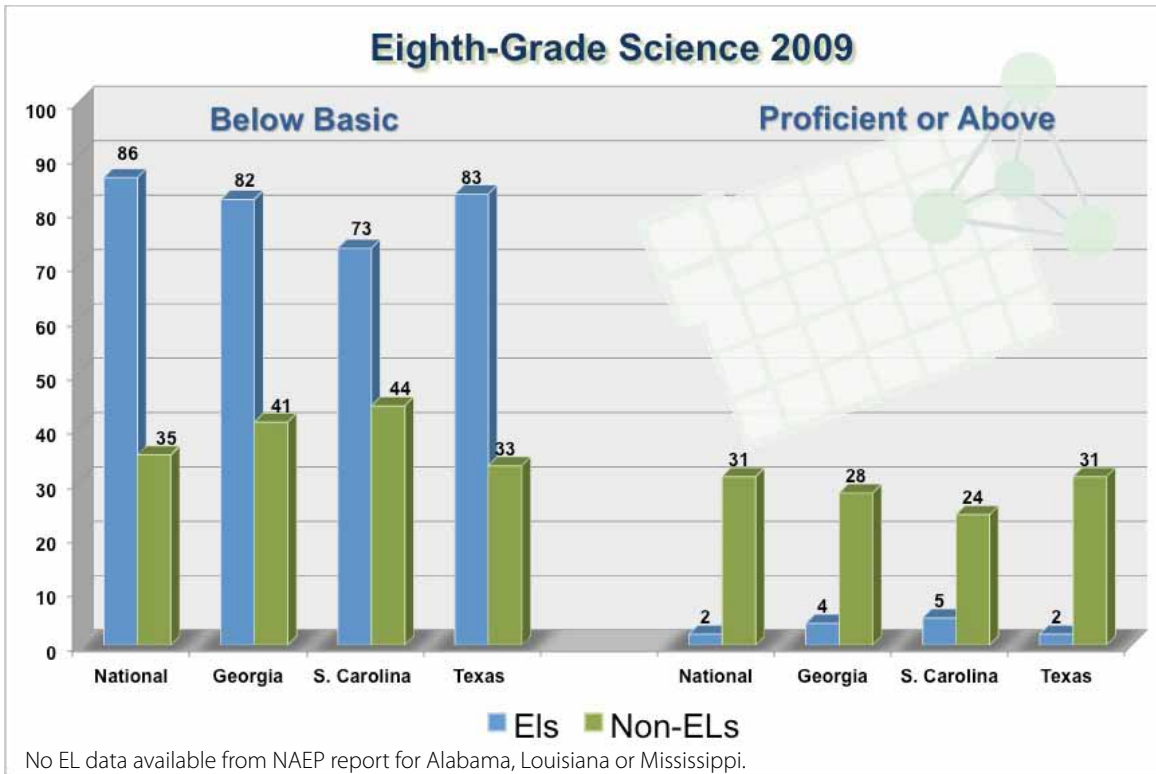
Teaching high-order thinking skills in addition to a subject’s content and language is a challenging task. But reading proficiently at the secondary level is an absolute necessity—not only for language arts, but in all content areas, including social studies, science and mathematics—because it is the means by which students receive the information they need for learning. Often, teachers of struggling ELs fail to teach and require them to read and write at the grade-appropriate level that is required for high-stakes exams (Coady, Hamann, Harrington, et al., 2004; Kong & Pearson, 2003). As a result, there is an achievement gap for ELs, who tend to score significantly lower than non-ELs; this gap is revealed by the National Assessment of Educational Progress (NAEP) scores.

Addressing the Gap

The existing gap at the secondary level is illustrated by the NAEP scores shown in Figure 1. The charts compare performance of 8th-grade ELs to that of non-ELs, showing the difference by contrasting the percentage of students below basic versus those proficient and above (IES, NCES, 2011). In part, this is due to what Kong and Pearson (2003) observed as a reductionist curriculum for ELs—one that focuses primarily on skill and drill. Studies have shown that this represents a disservice to these students (Fillmore, 1986; Gándara, Rumberger, Maxwell-Jolly, & Callahan, 2003; Moll, 1988).

Figure 1. Performance of ELs versus Non-ELs. Percentage of EL and non-EL populations scoring below basic versus proficient and above (IES, NCES, 2012).







Addressing this gap is beneficial for everyone—the quality of class instruction that works for ELs could benefit every student, though it is particularly necessary for ELs (Fitzgerald, 1995; Shanahan & Beck, 2006). The Education Alliance at Brown University convened a panel of researchers to examine promising practices for teaching ELs (Coady et al., 2004). They concluded that ELs are most successful when their teachers

- have high expectations and provide access to challenging content;
- model the skills, thinking, learning, reading, writing, and studying strategies needed for academic success;
- use a variety of strategies to help students understand difficult material;
- scaffold reading and writing in a variety of genres;
- provide opportunities for ELs to interact with teachers and classmates; and
- have sustained, high-quality professional development.

These and other studies (August & Hakuta, 1998; August & Shanahan, 2003; Welch-Ross, 2010) have identified classroom practices that are conducive to learning by all students, but they have also highlighted the role they play for ELs and revealed how rarely they are available to those students. Because native English speakers have the means to address many of their learning demands through their linguistic proficiency, it is possible for them to learn content even if the quality of instruction is not ideal. But it is extremely challenging for ELs to compensate for limitations on instructional language until they achieve some proficiency in English. They must learn linguistically embedded content while simultaneously acquiring academic language understanding.

For secondary teachers, who are primarily content-area teachers, training in specialized instruction for ELs is often limited; they receive training primarily in their specific subject areas and receive less instruction in strategies for special populations. Additional professional development in this area may also seem less relevant because they spend a limited amount of time with any particular EL. For the most part, they must also focus more on getting the content across in the 45-minute class periods usually found in secondary schools. However, among those teachers who do receive specific training for working with ELs, many have reported that the strategies they implement to accommodate the needs of the ELs prove beneficial to all of their students (Short, 2002). While the studies mentioned above provide background information about the needs of ELs, the Olson and Land study (2007) provides specific information on effective strategies for secondary ELs.

Olson and Land Study

The explicit teaching of cognitive strategies has been shown to be very beneficial for ELs in secondary school (Anderson & Roit, 1996; Fillmore & Snow, 2002; Klingner & Vaughn, 2004). In Olson and Land (2007), 55 ESL teachers (across 13 schools, in grades 6–12 in a district with a high density of EL students) received professional development to implement cognitive learning strategies to over 2000 students per year for a period of 8 years. Control teachers were selected from the same schools, one control teacher for each treatment teacher. Selection was based on the similarities between their students' English proficiency. A randomly selected subset of students received a pre-and-post test of their academic writing skills. Students receiving cognitive strategies instruction across content areas significantly out-gained peers on holistically scored assessments of academic writing for seven consecutive years. Treatment-group students also performed significantly better than control-group students on GPA, all standardized tests, and high-stakes writing assessments.

The study used the idea of a thinking tools kit to demonstrate the type of knowledge students needed and how to acquire it; the knowledge was taught through a toolbox analogy. **Declarative** knowledge strategies included describing what students knew or learned (e.g., what a hammer is and what it does). **Procedural** knowledge was their understanding of how to use a tool (e.g., how to use a hammer to nail boards together). **Conditional** knowledge was explained as their understanding of why and how a tool was the best instrument to do something (e.g., why and how the hammer is the best tool to nail two boards together). Teachers used different methods (explicit teaching, hands-on activities, etc.) to teach these cognitive strategies. For example, teachers used think-aloud to demonstrate the process of deciding how to approach each task by using different mental tools (e.g., analyzing an essay's title through previous knowledge of genre, author, content area or using their conditional knowledge). Several strategies, such as sentence starters and meta-cognitive reflections, were also adapted to tap into the knowledge types in the described thinking tools kit.

The description of the study indicated that it involved many, if not most, of the higher-order skills found to be necessary for succeeding on achievement tests, as reported by Fillmore and Snow (2002), as well as the teaching approaches recommended by Coady et al. (2004). However, in addition to the teachers' training, it seemed apparent that guiding students to acquire the thinking



tools for analyzing text and academic writing was an essential element of their success. As stated in their discussion, the authors felt that their findings would be strengthened by replication of the study with teachers randomly assigned to control or treatment groups. The treatment teachers in this study were volunteers, and limited data were collected on their relevant characteristics (e.g., ESL training, years of experience, etc.). Another improvement to this study could be to collect data on fidelity of implementation and on the comparability of the students' English proficiency level. Despite its limitations, the study showed that explicitly taught cognitive strategies could improve outcomes for secondary students.

The CREATE Studies

CREATE is one of the National Education Research and Development Centers, funded through the National Center for Education Research (NCER) at the U.S. Department of Education's Institute of Education Sciences (IES). As mentioned in the search method section of this report, a CREATE conference was convened in Austin, Texas in November of 2011. It brought together some of the leaders in research on the education of ELs—Diane August, David Francis, Kenji Hakuta, Freddie Hiebert, Russ Rumberger, Deborah Short, Catherine Snow, and Sharon Vaughn—to share the results of their studies. Two presentations at the conference addressed the specific subject matter of this paper and are discussed below.

August and Duguay (2011) reported findings from two studies on a science instruction intervention for teachers and their ELs to improve content knowledge, science language, and general academic language in science. The general pedagogical approach used was the 5E model (engage, explore, explain, elaborate, and evaluate) using strategies for active learning, review and reinforcement opportunities, graphic organizers, partner work, and use of data from formative assessments. The following changes made for ELs, with specific strategies, were discussed by presenters:

- Multiple means of content representation
 - Visuals and multi-media (PowerPoints, picture cards, video clips, graphic organizers, concept maps), written materials, classroom discourse
- Multiple ways to express knowledge
 - Demonstrating, speaking, writing
- Multiple ways to engage in the lessons
 - Individually, pairs, small groups, and whole groups
- Scaffolding to make content comprehensible
 - Additional teacher modeling (lab demonstrations, examples of what students have to produce)

Other adjustments included teaching curriculum in their first language (L1) for beginning ELs and using L1 materials as needed for intermediate ELs. The teachers used CREATE curriculum aligned to district and state objectives and received training and support while implementing the curriculum.

The researchers collected pre-and-post test data on over 4000 students in a total of 182 sections, randomly assigned to a control or a treatment group. The groups were assigned at the classroom level and involved 31 teachers. For 12 weeks, students received the intervention in two 45-minute sessions each week. In the first year, students in grade 7 received the intervention; in the second year, the same students received the intervention and a new cohort of students in grade 7 was added to the study. Grade vocabulary, comprehension, curriculum-based content, and weekly curriculum-based measures (CBM) were collected at the beginning and at the end of the year. All students improved in both comprehension and vocabulary. Treatment ELs scored better across all measures than control ELs and non-EL controls.

The second study (Vaughn & Reutebuch, 2011) reported on a social studies intervention for ELs in middle school. The intervention consisted of implementing multiple teaching and learning strategies to improve content knowledge, English language knowledge, and general academic language in social studies. Data were collected at three sites—pre-and-post test data on 1628 students in control and treatment groups. The intervention was randomly assigned at the classroom level for a total of 62 sections (32 treatment and 30 control groups) and included 15 different teachers. The strategies were implemented for 50 minutes each day, 5 days per week, and continued for a minimum of 12 weeks. The teachers used their own curriculum with supplemental materials, and they received training and direct support while implementing the program. The overarching goals of the social



studies activities were to focus explicitly on big ideas and concept learning, to use peer-mediated learning, and to provide opportunities for discourse. Adaptations included

- explicit vocabulary/concept instruction,
- strategic use of video and purposeful discussion to build concepts,
- use of graphic organizers and writing to build big ideas, and
- use of peer pairing.

The researchers also collected data on grade-level vocabulary and comprehension tests, curriculum-based content, and weekly CBM test scores. They reported that, while all students improved, the ELs did better across all measures than either the control ELs or the non-EL controls, on both comprehension and vocabulary tests.

Both of the above CREATE studies reported high measures of fidelity, and researchers provided support for the teachers during implementation. Multiple strategies were used in the studies; discussion of all the individual strategies is beyond the scope of this paper, but they were generally comparable across studies and are compiled into the three general categories shown in Table 3. The table indicates which strategies were common to both the August and Duguay (2011) and the Vaughn and Reutebuch (2011) studies, as well as which strategies were specific to only one of the studies. The top row summarizes the elements in both studies. Access to all strategies and some additional materials, along with detailed instructions and examples on how to use the strategies, are available at <http://www.cal.org/create/events/CREATE2011/index.html>

The CREATE web site provides access to the presentations from the conference, including examples of the strategies and some of the materials used in the science and social studies implementations. It also hosts the materials for all of the other general and breakout session presentations (such as those on SERP [Strategic Educational Research Partnership] explicit academic vocabulary teaching program and SIOP professional development program) and the keynote speakers' presentations.

Table 3. Summary of general strategies modified for ELs across two CREATE studies (August & Duguay, 2011; Vaughn & Reutebuch, 2011)

Summary of general strategies modified for ELs across two CREATE studies			
Studies	Direct vocabulary instruction at three levels	Immersion in language-rich environment	Building learning strategies to build meta-cognitive skills
Strategies used in both studies	Terms specific to content area, core and general academic vocabulary, explicit study of English forms	Teacher- and peer-led group discussions, peer interactive reading, and assignments for collaborative learning	Cross-linguistic analysis and high-order thinking skills
August & Duguay	Pre-teaching of content vocabulary and sheltered science content; pre-teaching of general academic vocabulary, contextualized by engagement activities and/or graphic organizer; study of English forms using follow-up on key words	Use of written goals and objectives, writing samples, and diverse text to give students access to content and language models; opportunities to share ideas in peer groups for each assignment; charts and other graphics to guide collaborative work and discussion	Explicit objectives (content, academic, and language); connection to students' previous knowledge; study of cognates between English and Spanish, contextualized by science content; graphic organizers of concepts and linguistics; critical writing
Vaughn & Reutebuch	Explicit vocabulary instruction: Pre-teaching of content-area words, study of Spanish cognates, repeated exposure to the same vocabulary	Peer-mediated learning and guided discourse, peer- and teacher-led read aloud	Strategically chosen video clips to connect to concepts, graphic organizers and log writing, students generating their own questions about the content

Language Teaching Pedagogy

In addition to strategies aimed specifically at helping ELs learn content (i.e., those mentioned in Olson and Land's 2007 study and the CREATE presentations) accelerating their English language acquisition will aid ELs in learning academic content. Some language teaching strategies that could be taught simultaneously come from language learning pedagogy. English as a Second Language (ESL) programs have been in existence for many years and there is considerable research on their successful implementation. The ESL strategies below are supported by educators in second language acquisition (Bardovi-Harlig & Hartford, 1997; Brown, 2007; Faltis & Coulter, 2008; Morgan, 1998; Ovando & Collier, 1998; Peregoy & Boyle, 2005; Quiocho & Utanoff, 2009). They are discussed here to help differentiate various needs and depict the type of planning teachers need to do.



Speaking

When beginning to learn English, ELs gain the majority of their understanding through hearing oral language (Coady et al., 2006). They learn by contextualizing what they hear to determine the meaning of the spoken words. Thus, in the early stages of language acquisition, ELs spend much time listening to oral language contextualized by social interactions and academic activities, even if they are not yet speaking aloud or volunteering information spontaneously. The use of clear and concise speech can help ELs decipher important parts of what is being said. Teachers can facilitate this without singling out EL students or taking away instructional time. This can be done through paraphrasing and repeating or emphasizing key words or sentences. In addition, a teacher can give directions in different ways, such as using hand gestures, pictures, and props to make the message more transparent (Teale, 2009).

Although most strategies that help ELs also benefit other students, the ones discussed below are needed especially by ELs (Shanahan & Beck, 2006). To build auditory discrimination skills, ELs benefit from increased attention to or emphasis on sounds that do not occur in their native language. Additionally, vocabulary acquisition may be easier if the words that teachers introduce can be connected to a student's native language (e.g., Spanish/English cognates).

When students begin to speak, the classroom environment should be a sanctuary where there is no negative criticism of their spoken language. Students should feel safe in taking the risk of expressing their thoughts, even if the language form is not correct. Several ways of easing participation by students include allowing them more silent work time to construct their sentences without stressing them; giving them questions in advance so they can prepare their sentences or responses in advance; and allowing them to rehearse their answers or write them down if necessary.

Fillmore (1986) reported that ELs showed growth in the language of instruction when they had the opportunity to interact with native and native-like speakers and when they had access to a language-rich classroom environment. A language-rich classroom is one that provides multiple opportunities for discussion, modeling, and scaffolding of appropriate classroom discourse (Teale, 2009). Allowing more time for independent reading, reading to students, and engaging students in planned and purposeful peer discussions will improve reading skills and comprehension of concepts. Explicit instruction in both reading and writing across content areas should be used—in addition to language instruction—to facilitate comprehension of content or concepts (Bauer, Manyak, & Cook, 2010; Manyak, 2007).

Although ELs may benefit most from one-on-one interactions with the teacher and teacher-led pre-reading and vocabulary instruction, these types of activities are more difficult for secondary teachers to implement. Compared to elementary teachers they have larger classes and less time with each class (typically only 45 minutes per day). Good language models do not necessarily have to be teachers; student peers with high levels of English proficiency could also make good models when guided by planned discussion. For example, to model the academic language, it is helpful to allow pair discussion before responding or writing, especially if ELs are grouped with peers who have more experience using classroom discourse. Thus, the addition of planned peer-focused activities could be very helpful, as long as these activities merely supplement and not supplant teacher-led instruction.

If the classroom is viewed as a social system, in an equitable classroom, the teacher delegates authority to groups of students and holds them accountable for their learning; the students then work together to acquire knowledge (Cohen, 1997). An additional benefit may result from building a classroom community. A student who feels he or she is part of a community may be able to identify with the other members in it and learn indirectly from teacher/student exchanges even if he or she is not involved directly (Tudge, 2004).

Writing and Assessment

Tompkins (2009) described the language experience approach (LEA) used in second language learning to develop writing and speaking skills. In this strategy, language learners dictate words and sentences about a picture or a personal experience to the teacher or an English proficient student, who writes them down, modeling the correct use of written language. The process might begin with a description of a galaxy from the internet. As students build their vocabulary, they become more comfortable and proficient at participating in the LEA, dictating sentences that represent experiences from their own lives. They may also use this strategy for reports of academic tasks from the classroom. Using spoken English, with the written English words and structure being provided by the teacher or peer, helps develop ELs' academic writing and understanding of concepts.



Using regular assessments with ELs causes uneasiness for most teachers (Helfrich & Bosh, 2011). Teachers must use caution when choosing assessments, because some may not be valid or reliable measures to use with ELs. Some assessment measures may also be linguistically or culturally biased, which could negatively affect the results (García, McKoon, & August, 2008; Kornhaber 2004). It is important for teachers to discuss these concerns with specialists in their schools, such as the reading specialist or special education teacher, who may have more knowledge of various assessment measures. This is especially important when a teacher has a concern about a student's possible eligibility for extended or special services, regardless of whether the student is an EL or non-EL. Assessment should be ongoing and linked with instruction (Teale, 2009) and should occur frequently to ensure that instruction is and remains effective and that students receive specific interventions as needed (Huebner, 2009).

Teachers are encouraged to use self-developed assessments, such as cloze procedures and curriculum-based measures, when assessing ELs in the classroom. In a cloze procedure, students are asked to supply missing words to complete sentences in a passage. In their review of research on assessment, García et al. (2008) examined studies on teacher-developed cloze procedures and curriculum-based assessments that require students to read a passage aloud while the teacher scores miscues. They found these were effective in helping teachers better understand students' oral language proficiency and fluency, although they did not necessarily aid in assessing students' mastery of content. Mispronounced words may relate to incomplete comprehension of the content or to more general difficulties with English. If the miscues are with content-specific vocabulary, this may be an indication that the EL needs additional work with the content. If the errors are with words in general English usage and not directly related to the content, it would be appropriate to visit with the EL specialist about targeting this vocabulary.

ELs can also be allowed to verbalize rather than write answers to comprehension questions. This lets the teacher assess comprehension at a more basic level; a written answer may place undue attention on the student's writing skills and not accurately reflect what he/she has learned. When informal verbal assessment is used, it can be done situationally so that many students are encouraged to speak aloud and the EL is not singled out.

Conclusion

The evident scarcity of research on teaching strategies for ELs in math, science, and social studies at the secondary level is distressing, especially in the context of the nation's effort to improve science, technology, engineering, and math (STEM) skills. For a variety of reasons, it is difficult for ELs to reach levels of academic achievement comparable to those of their non-EL peers. Foremost among them are the highly demanding skills required to do well on tests in the STEM areas. A second factor is the set of linguistic challenges ELs face at the secondary level, in addition to those faced by ELs in general. The limited resources and support available exacerbate these challenges for secondary ELs. Obstacles to learning such as these are particularly worrisome in this age of high accountability for schools.

However, there is research that suggests some strategies teachers might consider for assisting ELs in secondary science, mathematics, and social studies. These strategies include explicit teaching of cognitive learning strategies, explicit vocabulary/concept instruction, pairing with native speakers, and graphic organizers.



Summaries of Work in States Served by the SEDL's Comprehensive Centers

States served by SEDL's TXCC and SECC were invited to contribute information about work being done with English learners in their state. The following summaries were provided by staff from the respective state education agencies (SEAs).

Alabama's Focus on Research-Based Strategies to Reach and Teach English Learners

English Learner (EL) Coaches

In August of 2011 Alabama streamlined the work of the EL coaches to mirror the work of the School Improvement Team. This joint effort resulted in more consistency between the work of districts not making annual measurable achievement objectives (AMAOs) and adequate yearly progress (AYP). EL coaches work with districts on the LEA improvement plan and help implement research-based strategies for improvement districtwide. Once a target school is identified, EL coaches help the target school write and implement a Continuous Improvement Plan (CIP) with a focus on EL. EL coaches model and implement the "I do, We do, You do" coaching model. The EL coaches provide monthly support for districts being served.



SAMUEL (School Assistance Meetings for Understanding English Learners) Series

This is the second year for the SAMUEL (School Assistance Meetings for Understanding English Learners) Series to be provided statewide. The series consists of four sessions provided regionally. These sessions are designed for a broad audience to include EL teachers, general education teachers, administrators, counselors and anyone who has from limited to in-depth knowledge of how to provide appropriate instruction to English learners. The SDE develops these topics from areas identified through monitoring visits and other data collection tools from the prior year. SAMUEL sessions are presented regionally by our EL coaches. During 2010–2011 approximately 700 participants attended each of the four sessions provided statewide. Topics for the 2011–2012 SAMUEL series include these:

- Interpreting ACCESS for ELLs' Scores, Student Goal Setting & Creating Language Objectives
- Building Background: One Piece at a Time
- Sheltered Instruction Strategies & Interaction
- Differentiated Instruction for EL & eCIP Goals/Action Steps

EL Summer School

The EL Summer School collaborative experience was a great success. This program allowed select SDE staff, local school district staff, and community agencies the opportunity to work with EL children in an academic setting during their EL Summer School week. Instruction was planned around the Scott Foresman Reading Series used in the district. During the week the stories were expanded across the curriculum with the infusion of the WIDA ELP standards. The use of differentiation and research-based strategies by the staff made learning meaningful for EL students. As one child left she said, "I don't want to leave." What a telling story of the impact this program had on these EL students.



Success in South Carolina: What is working for SC English learners can work in other states and for other subgroups

South Carolina over the last few years had the fastest growth in the nation's English learner (EL) population and continues to be in the top ten in its EL population growth. Despite the rapid growth of ELs in SC, our ELs are seeing great successes. SC ELs had the lowest achievement gap between ELs and non-ELs in the nation, according to EdWeek in 2009. Our state data also show that our ELs are out-performing many of our non-EL subgroups. ELs have also made AYP at the State level in ELA and mathematics for the last three years.

In South Carolina, we provide training on how to meet the needs of ELs. We also do not prescribe or mandate one particular program model or strategy, but focus on tailoring each English learner's instructional program to his or her individual needs. We also have a retention policy that requires teachers to accommodate their ELs appropriately, based on their level of English proficiency and individual learning needs, instead of using retention as a quick-fix. We've found appropriately accommodating and supporting our ELs so they can access and master grade-level content standards, while filling in English language deficiencies in specific content areas as they develop English proficiency, to be an effective way to help our ELs achieve academic success and access grade-level content. We know that students at all levels of English proficiency can access every level of Bloom's Taxonomy with appropriate accommodations and should be challenged to do so. The strategies that are working for our ELs are not special strategies that work only for ELs, but are best teaching practices that can work for all struggling learners.

Other main contributors to the successes of our ELs are the support systems provided to ELs in many of our schools and districts, such as, before-, after-, and summer-school programs. We challenge districts to think outside of the box in how they use Title III and other funds to support our ELs, rather than focusing solely on any particular boxed curriculum or program—i.e., looking at innovative ways to use their funds. Many of our districts have seen great results with using technology and with offering additional support to students in before-, after-, and summer-school initiatives. Additionally, ESOL programs have become more rigorous and data driven in the last few years, including how data are collected; how the state's English proficiency test (ELDA), statewide content tests, classroom assessments, and other student data at the state, district, and school levels are monitored; and also how data are used more effectively to inform ESOL programs. At the state level we emphasize that districts should not solely rely on the latest claims of research-based programs and practices, but should conduct their own research of what is and what is not working with their students. What may work in one state may not work in another; what works in one district may not work in another; and what works with one student may not work with another. That is why we encourage teachers to differentiate instruction and use multiple strategies, approaches, and modalities, tailored to each individual student's English proficiency, learning needs, and prior knowledge.

Additionally, at the state level our Title III/ESOL staff work across divisions with multiple offices—such as the offices of Standards and Support, Certification, Assessment, Exceptional Children, Gifted and Talented, Data Management and Analysis, Title I, Supplemental Educational Services, and Accreditation—to support our diverse group of ELs. Our ELs range from ELs with disabilities to ELs that are gifted and talented, and we work to make sure that students are appropriately screened and served and have equal access to and participate in all programs as appropriate and in accordance with federal and state requirements. We work closely with our offices of Data Management and Analysis and Assessment to conduct research at the state level and to review and disaggregate data, such as the number of ELs that are placed in special programs (e.g., Special Education and Gifted and Talented), the number of ESOL retentions in each district, areas of strength and weakness on English proficiency and other tests. Other data collected include the number of ELs in each district, the number of languages spoken, the type of instruction each student is receiving, the English proficiency level of each student, and each student's progress toward becoming proficient in English. We also collect data on how long it takes students to become proficient in English and in each content area on statewide assessments.

Furthermore, many more professional development activities are provided to ESOL and regular classroom teachers, special education staff, guidance counselors, administrators, paraprofessionals, and others that work with English learners. Teaching ELs has become a community responsibility. Approximately 30 Title III monitoring visits are conducted each year to help districts



improve their services to ELs and their families. Another critical piece is that SC's ESOL instruction is linked to academic content standards and regular classroom instruction rather than sporadic, disconnected instruction that has little or no connection to grade-level content standards and to what students are learning in their regular classrooms. Teachers who differentiate instruction for diverse learners are another great contribution to the success of our ELs.

Parent involvement is also an important part of our success. All districts, in order to receive Title III funds, are required to make sure that their district is supporting parents and encouraging their involvement in their child's education by providing information to parents in a language they can understand. Schools and districts have translators and/or translation services that ensure parents are getting important information about their child's education. Many schools and districts have parent liaisons to encourage and improve parent and family involvement in the community. The parent liaison serves as a liaison between the school itself and the students' families. Parent liaisons personally contact parents and families in an effort to encourage further participation in their community. They also coach parents on how to become more involved in their child's education.

Finally, the most important ingredients are loving and caring teachers, administrators, and staff that let our ELs know they are valued and that we believe in them. We are seeing great things from our SC ELs that can be replicated in other states and among other subgroups. We must use our knowledge of what is working and what is not working to inform how we address the academic needs of all of our students.

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