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English Learner Classification Status and Stem Access

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ABSTRACT

The article proves the means of English learner classification and STEAM learning. English learners (ELs) develop science, technology, engineering, art and mathematics (STEAM) knowledge and language proficiency when they are engaged in meaningful interaction in the classroom and participate in the kinds of activities in which STEAM experts and professionals regularly engage. This article describes that ELs typically have varying levels of proficiency, both across modes of language use (reading, writing, speaking, listening) and across domains of knowledge, according to opportunities they have had to learn and use language.

English learners (ELs) in schools vary in many ways, in their home languages and the cultures they represent, their proficiency in their home language, the age at which they enter school and their prior schooling in other contexts, and their language abilities and prior knowledge about science, technology, engineering, and mathematics (STEM) subjects. The variability within the EL population was articulated by the National Academies of Sciences, Engineering, and Medicine report Promoting the Educational Success of Children and Youth Learning English. ELs vary in their home language, language abilities, age, race/ethnicity, immigration circumstances, generational status in the country, geographic distribution, academic achievement, parental characteristics and socioeconomic resources, disability status, and other demographic attributes. Thus, while on average, ELs have a number of unique characteristics that distinguish them from the general population of non-ELs, broad comparisons of ELs with non-ELs mask significant heterogeneity within both groups. Of greatest importance, in relation to placement for STEM learning, is their prior knowledge about STEM subjects, but children are not typically assessed for their content knowledge when entering schools. Instead, their identification and course placement, at least at the secondary level, is typically determined by their level of English proficiency. As this report 27 English Learners in STEM Subjects:

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ELs typically have varying levels of proficiency, both across modes of language use (reading, writing, speaking, listening) and across domains of knowledge, according to opportunities they have had to learn and use language. In addition, the experiences of ELs entering schools in kindergarten are different from those of ELs entering schools in late elementary through high school, as older children have greater levels of cognitive development and may have formal knowledge of STEM subjects developed in other contexts. Additionally, some older students may not be orally proficient in English, but may have English reading and writing skills based on prior educational experiences in English in their home countries, which facilitates their pathway to English proficiency and STEM learning in English. On the other hand, some ELs may come to schools in the secondary years without knowledge of English. They may also have experienced interrupted schooling or significant trauma that prevented them from developing literacy in their primary language or formal knowledge in STEM subjects. This report outlines ways that STEM programs can be designed to offer access to STEM learning opportunities for this range of ELs. Below we discuss key issues that currently shape the extent to which STEM learning opportunities are accessible to ELs, including (1) the heterogeneity of ELs; (2) the program models through which ELs gain access to STEM subjects; (3) the processes of classification and reclassification of ELs that shape their access to STEM learning; (4) the academic achievement gap; and (5) the particular issues that affect placement of ELs in STEM courses at the secondary level.

Unpacking the Complexity of the Heterogeneity of English Learner (EL) Students Effectively addressing heterogeneity is critical to properly supporting ELs to have access to STEM subjects through placement, instruction, and assessment. This heterogeneity has two facets. The first concerns the wide linguistic diversity and complex geographical distribution of ELs. As a result of this variety, each EL student has a unique set of linguistic skills. For example, two ELs who are in the same classroom and are native users of the same language may differ considerably in their skills across the four language modalities (listening, speaking, reading, and writing) in each of their two languages. Even if both are fluent in conversation in their first language, their reading and writing skills in the first language may vary considerably if one has a history of instruction in that language and the other does not. Clearly, broad categories of English proficiency do not provide the kind of information on English proficiency that is needed to make sound decisions for ELs. Legislation, policies, programs, and instructional and assessment strategies are limited in their effectiveness to serve ELs when this tremendous heterogeneity is not recognized. For example, testing all ELs in their first language could be more harmful than beneficial for those who have received limited formal instruction (and, therefore, have developed limited reading and writing skills) in that language. Particularly concerning is the fact that this failure to address heterogeneity may lead educators and schools to overestimate proficiency in the first language and to underestimate English proficiency. Decisions concerning instruction and assessment need to be made based on recognizing the tremendous heterogeneity of EL populations if their access to STEM content is to be effectively supported. Proper strategies in instruction and assessment include (1) making decisions based on detailed information on proficiency in the four language modalities of English, beyond the simple use of broad classification categories; (2) using multiple sources of information (in addition to scores on English proficiency tests) in judging students' English proficiency; (3) looking for approaches that are sensitive to each student's needs; (4) avoiding making assumptions about the proficiency of students in English or in their native language; and (5) encouraging educators to develop a good sense of each of their ELs' strengths in English, based on continuously interacting with them.

The initial difficulties newcomers experience may be linked to having to adjust to a new language and culture while developing literacy as well as oral and academic proficiency in English in a relatively brief period of time. Newcomers often receive specialized ESL instruction that socializes them into the new school practices they encounter and provides opportunities for language development calibrated to their newcomer status. However, even newcomers can interact with children who speak English and participate and contribute in authentic STEM learning contexts. As newcomers begin to use language to learn and interact socially, their interaction with peers and adults in authentic learning contexts leads to continued control of English. Linguistic Heterogeneity If teachers get information about the ELs in their classrooms, the students' English proficiency may be reported at particular levels of proficiency in listening, reading (language comprehension), speaking, and writing (language production), or they may receive an overall proficiency level. However, research has suggested that formal, largely summative, large-scale language assessments may be a problematic way to measure language proficiency, missing much of the communicative aspects of authentic classroom interaction during instruction. ELs vary in their control of these different skills and this can interact with their prior schooling. Given this variability in the EL population, it is important for educators to find out what learners know about STEM subjects from their previous schooling and experiences, and to connect with and build on prior learning in their first languages. As stated in previous reports, ELs can develop fluency in language and the language of STEM subjects over several years of engagement and participation in gradeappropriate activities. Although the process of language learning is similar for all students, ELs experience different overall trajectories in their learning of language and STEM content related to their ages and levels of English proficiency, prior knowledge, and community context. As described above, older children who can read and write in their first language may have an advantage over younger children who have yet to develop literacy in any language. Younger children may need additional support when learning language and STEM content. With respect to community context, children who live in more linguistically homogeneous communities are well positioned to draw on their first-language proficiency as an asset in STEM learning, making bilingual education and/or strategic use of the first language in the classroom an important part of their learning contexts.

Using Linguagrams to Understand the Heterogeneity of English Learners (ELs) in the Classroom Linguagrams are conceptual tools created with the intent to support teachers to reason about the linguistic heterogeneity of EL students in their classrooms. A linguagram consists of a symmetric bar graph that represents an individual's proficiency in English and in their first language in each of the four language modalities—listening, speaking, reading, and writing—on a scale that ranges from 0 (total lack of proficiency) to 100 (full proficiency). The figure below shows the linguagrams of three hypothetical EL students who are in the same classroom and are native speakers of the same language. Different personal experiences (e.g., family, community, friends) and different schooling histories produce different sets of opportunities to become proficient in listening (L), speaking (S), reading (R), and writing (W) in each language. The three cases shown are among the many possible combinations of levels of proficiency that different ELs may have in their two languages. To reason about the linguistic diversity in their classrooms, teachers can be asked to construct linguagrams of each of their EL students using information from multiple sources, in addition to test scores. Examples of these sources are observations of the students interacting with other ELs or with never-EL students, teachers' informal interactions with the students, students' participation in class, examination of students' written work, and conversations with the students' parents (e.g., to know the students' schooling history). Linguagrams are not a formal assessment instrument, but a tool to support teachers to realize that (1) little information is typically available about their EL students' proficiency in English or in their first language; (2) although useful, information from tests of language proficiency does not have the level of detail needed to know exactly how to support ELs in the

classroom; (3) a great deal of the information needed to develop a good sense of the linguistic proficiency of ELs needs to be obtained through socially interacting with them; (4) each EL has a unique pattern of language dominance; and (5) language proficiency varies considerably across contexts (e.g., in class, during a mathematics conversation, or in informal situations).

Although current research focuses more closely on the language in instruction, regardless of whether that language is the home language or English, the language models under which a student has learned represent an important dimension of the heterogeneity of schooling experiences. In other words, whereas current research focuses more on the quality of the language used in instruction than on the choice of whether to deliver instruction in the children's home language or the societal language, this choice of the language of instruction marks an important dimension along with ELs educational experiences differ. Moreover, the variety of program models and variability in the quality of instruction under all program models complicates the process of drawing inferences from the literature on effective practices. Program models can first be distinguished by their use of students' primary language in instruction. These programs, whether it be an ESL or bilingual program model, differ in their emphasis on the primary language. For example, in transitional programs, the primary language is viewed as a bridge to support instruction until students can function independently in English-only instruction. Transitional programs differ from one another not only in the timing of the transition to English but also in the extent to which primary language is used in content and literacy instruction. Developmental bilingual programs and maintenance programs view primary language as a cognitive resource to develop and/or maintain throughout the child's time in the program. This development typically occurs in literacy instruction and occasionally in content area instruction. Dual-language programs (see Two-Way Dual Language Immersion in table) differ in that by design they include never ELs who seek to become proficient in a language other than English. This type of program offers content instruction in all subject areas in and across both languages of instruction. Program labels mask the heterogeneity in instructional settings, in the extent of English and primary language in instruction, the areas of instruction in which the two languages might be used, and the quality of the instruction. Moreover, program labels imply an approach to instruction that may not extend to content area instruction. One cannot assume that bilingual instruction extends to instruction in STEM, nor can one assume that ELs are receiving STEM instruction, regardless of the program label. These circumstances mean that ELs may have little access to grade-appropriate STEM content and will continue to fall behind in their STEM development as the challenges of STEM learning increase at every grade level. These trends have historical roots in federal policy. For example, the Bilingual Education Act of 1968 framed bilingual instruction as a means to English proficiency rather than as support for continued subject area learning as students learn English. Given that the underlying goal of this policy was to move students to English-only instruction as quickly as possible, bilingual programs have not always provided support for ELs' continued development of grade-level content knowledge. Even when bilingual programs are offered, the provision of primary language support for STEM learning is uneven, as some programs are designed such that students engage in language arts instruction in their primary language, but mathematics and science instruction is offered only in English. It is important to note that research on program models has tended to focus on student performance in reading and mathematics and has concentrated in the elementary grades, suggesting a need for further research. This focus is not surprising given that federal policy has not legislated assessment of student outcomes in science until recently, and even now science is assessed in a limited number of grades in comparison to reading and mathematics. This general lack of focus on STEM outcomes beyond mathematics until recently and these sources of variation that exist even within programs of the same type are important for the reader to keep in mind in the discussions about supporting teachers, structuring classrooms, and setting policies in later chapters. The first of these had led to a paucity of focused research on STEM instruction for ELs whereas the latter complicates the formation of

easy generalizations from the research that does exist. Moreover, continuing to develop ELs' content knowledge through bilingual support clearly shapes students' long-term academic trajectories. In a lottery study using seven cohorts of students who applied at a PreK or kindergarten immersion program, Scientists found that there was a 6 percentage point reduction in the probability of being classified as an EL in 5th grade and a 14 point reduction in 6th grade; however, the effects on mathematics and science learning were less evident. Valentino and Reardon (2015) examined four different instructional program models—Transitional Bilingual (TB), English Immersion (EI), Developmental Bilingual (DB), and Dual Immersion (DI)—and ELs' academic outcomes in English language arts and mathematics. They found that in 2nd grade, mathematics scores of ELs enrolled in all program models were significantly higher than the state average, with those enrolled in DB and TB classrooms even higher, respectively. However, by 7th grade, the rate of growth was slowest for DB classrooms, about average for EI and DI programs, and those in TB programs were higher than the state average. At the same time, Umansky (2016) used a regression discontinuity design to assess the impact of program model by comparing students classified as EL and students with similar language skills who just missed being classified as EL. Umansky (2016) found a negative effect of EL classification on content area outcomes where students were enrolled in EI programs that was not present for students enrolled in bilingual instruction. Regardless of any conclusions about specific program models, what is clear from this research is that, even very early on, the language of instruction shapes ELs' content area access and academic trajectories. The advantages of bilingual and primary language instruction identified above are not automatically obtained, nor are bilingual programs the norm in the United States. Whereas quality bilingual instructional programs could be more widespread than they are, the diversity of languages spoken by school children, the dearth of qualified bilingual educators, and the sparse representation of some languages in some locales make instruction in the primary language not always feasible. These factors necessitate that all schools be prepared to provide high-quality instruction to ELs, regardless of the choice of language program model within that school, including the implementation of effective programs within that school.

The classification of students as EL is complex and varies considerably across states, and even across districts within states. Initial EL classification is determined by a student's level as demonstrated by standardized assessment results. Although in many states, the state assessment is the sole criterion for classification and reclassification as English proficient, or a student's readiness to exit EL status and related programs and services, other criteria include (1) academic achievement measured by standardized test scores and/or grades in English language arts and/or mathematics, (2) teacher evaluation, and (3) in some cases, parent consultation and/or approval. The inclusion of the second indicator, which requires that ELs perform at grade level in school subjects before being reclassified, varies across states and districts within states, and is used in some states with large EL populations. While including proficiency in content achievement as a criterion for language proficiency appears reasonable, the fact that many students who are non-ELs are not proficient in content achievement raises questions about content achievement as a criterion for English proficiency. Most importantly, tying reclassification to content achievement often delays reclassification and precludes ELs from being enrolled in STEM courses. In this sense, EL status penalizes students by preventing them from having access to academically rigorous curricula, in spite of research indicating that access to academic content is associated with ELs' achievement, as it is for non-ELs. Moreover, given that students continuously enter and exit EL status, it is challenging to develop complete understandings of how ELs fare in schools and classrooms, and the extent to which both ELs and reclassified ELs have access to rigorous STEM content. Reclassification is a challenging issue, as both too-early reclassification and too-late reclassification have negative outcomes for ELs. For ELs, as for all young children, language development continues in the early elementary grades as they continue developing literacy skills, so ensuring that EL supports are reduced at the appropriate time is an important

issue. Although early reclassification may appear to indicate success, long-term consequences with respect to retention and attrition matter more in the long run. Most ELs continue to benefit from language support even after they demonstrate conversational fluency and ability to participate fully with the curriculum in the earliest grades. On the other hand, keeping ELs in specialized language programs can prevent them from having access to STEM learning opportunities. Reclassification by the end of the elementary grades, for example, is important for facilitating ELs' access to advanced STEM courses in high school. In a longitudinal analysis of student-level data from the Los Angeles Unified School District, the largest EL-enrolling school district in the nation, Thompson (2017a) found that the vast majority of ELs demonstrated English language proficiency within 4–7 years. However, her analyses also indicated that if a student missed the late elementary reclassification window, the likelihood of ever reclassifying dropped significantly. In fact, a full 25 percent of ELs remained classified after 9 years in the school system. Thompson (2015) also showed how missing the reclassification window can result in long-term EL status and continued placement in EL isolated programs that provide limited access to grade-level curriculum. Specifically, Thompson (2017b) showed how external, organizational constraints prevent long-term EL students from advancing in mathematics. However, barriers to EL students extend beyond access to courses. Callahan and Humphries (2016) further showed how EL students experience lower returns on advanced mathematics course-taking relative to both other immigrants and native-born, native-English speakers. Even when EL students manage to complete honors-level advanced mathematics, calculus or beyond, they fail to receive the same boost in 4-year college-going experienced by all other student groups. These effects are present even after controlling for student performance in advanced mathematics courses. Accuracy in reclassification is especially important because the retention of students in EL status longer than necessary also results in stigmatizing, negative educational experiences and can be academically and linguistically detrimental to students. Often, long-term ELs internalize the negative social and academic perceptions that have come to characterize EL-focused courses and programs. These negative perceptions are fueled in part by the inaccurate reporting of student achievement among students who enter school as ELs that results from the routine exclusion of reclassified ELs when reporting on EL achievement.

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