

Six Strategies to Reach, Teach, and Close Math Gaps

FOR LATINO ENGLISH LANGUAGE LEARNERS IN
ELEMENTARY AND MIDDLE SCHOOL

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WHITE PAPER | DREAMBOX LEARNING®

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Introduction

Learning and understanding the unique language of math can be a challenge for many of the 3.8 million¹ Latino English Language Learners (ELLs) in U.S. elementary and middle school classrooms. **One in every four students in the U.S. will be of Latino descent by 2020.**² Therefore, providing equity and access to educational opportunities is of paramount importance, especially in light of wide, persistent gaps in math achievement.

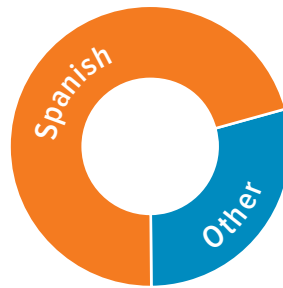
At DreamBox Learning[®], we believe that all children can learn and excel in mathematics, no matter where they start, where they live, or what their home language may be. Every Latino ELL must be challenged, encouraged, and engaged in an individual way while we support them so they can all meet the highest standards and expectations in mathematics.

For educators seeking to reach and teach Latino ELLs, this white paper suggests six powerful classroom strategies that can create a dynamic shift in each learner's confidence and an improvement in math performance.

Who Are Latino ELLs?

The majority – 71 percent – of English Language Learners in the U.S. public school system speak Spanish as their first language.³ Their families come from many different parts of the world: Spain, Puerto Rico, Cuba, Mexico, and Central and South America. Culturally diverse, they have varying levels of second-language fluency, prior knowledge in mathematics, and confidence in their learning abilities.

71% of the 4.5 million English Language Learners



in public schools
speak Spanish
as their first language.



Source: [Migration Policy Institute](#) and [National Center for Education Statistics](#)

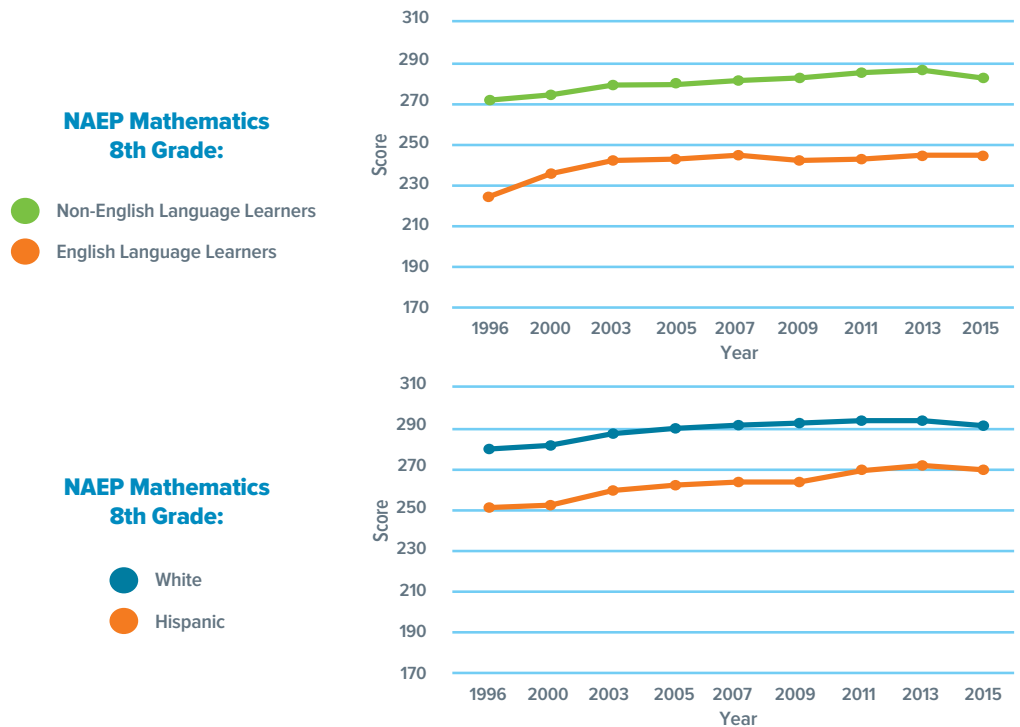
Despite this diversity, these students have some characteristics in common, and whether born in the U.S.⁴ or not, they have the lowest education attainment level of any group in the country. In addition, as a group they show significant gaps in math scores compared to their peers.⁵ They also share a strong need for equity and access to the high-quality education that we want for all students.

English Language Learners, or ELLs, are students who are unable to communicate fluently in English and often come from non-English-speaking homes and backgrounds. They may have difficulty learning effectively in English and typically require specialized or modified instruction in both the English language and in their academic courses.

ONGOING ACHIEVEMENT GAPS SINCE THE 1990S

While there is no single source of national statistics focused specifically on the math achievement of Latino ELLs, we can identify trends by looking at available national scores for ELLs and Latinos (“Hispanics” in the cited data source). National Center for Education Statistics (NCES) data shows that while scores have improved, achievement gaps have remained relatively unchanged since the 1990s when compared to the scores of other eighth grade students.

Significant gaps in NAEP math scores since the 1990s.



Source: [NAEP statistics 1996–2015](#)

Consider the achievement gaps in the charts above and you’ll see persistent trends for Latino math learners, the majority of whom are ELLs.⁶ As reported by the National Assessment of Education Progress (NAEP), while math scores are improving for both Latino and white students, they are improving at roughly the same rate. Therefore, the achievement gap—which can be as significant as a difference of four grades—has remained relatively unchanged since the 1990s.⁷ This includes the gap that widens in the eighth grade, a point that serves as an early risk predictor for the likelihood of students to drop out of high school.⁸ As educators, our goal is to disrupt this trend and help Latino ELLs reach the same levels of math achievement as their peers.

Six Gap-Closing Classroom Math Strategies

Many of the impediments to academic achievement for Latino ELLs can't be overcome solely in elementary and middle school classrooms. In addition to the language challenge, ELLs can be adversely affected by lack of resources, summer learning loss, poverty, and frequent moves, just as non-ELLs can be. Yet *No Child Left Behind* has put significant pressure on districts and schools to ensure that all students succeed by simultaneously raising both the language and mathematics proficiency of ELLs as measured by standardized tests. Furthermore, some state legislation affects academic standards and determines the environment in which ELLs are taught—English-only, bilingual, or a combination of the two.⁹

What we can do in classrooms is use research-based best practices to improve access and equity as recommended by the National Council of Teachers of Mathematics (NCTM). NCTM rightly advocates for equity in our schools and curricula and points out that “Excellence in mathematics education requires equity—high expectations and strong support for all students.”¹⁰

1 UTILIZE BILINGUAL FACULTY AND SUPPORT STAFF: *Hire Spanish-speaking teachers and support staff to take advantage of Spanish home-language fluency. These human resources can support math learning and English language acquisition both formally through the curriculum and instruction, and informally through classroom interaction.*

Recent research has shown that having a bilingual teacher not only helps ELLs comprehend academic material, but it also helps increase attendance and graduation rates.¹¹ It's an ideal situation: educators who are bilingual Spanish-speakers themselves or ancillary staff who can provide Spanish-language support are well-equipped to improve math proficiency and provide a more accurate assessment of where students are in their learning. The unfortunate reality is that bilingual faculty and staff might not be an option in budget-strapped schools.

There is evidence that this approach to supporting ELLs helps students build math skills as they build vocabulary in both English and mathematics.¹² *The Inclusive Classroom, Teaching Mathematics and Science to English-Language Learners*¹³ supports the idea that when students use their native language in the classroom to work with their peers or individually, their academic performance as well as English-language development improves. Skills in content areas like mathematics and social studies, once understood in the first language, are retained when instruction shifts to the second language.

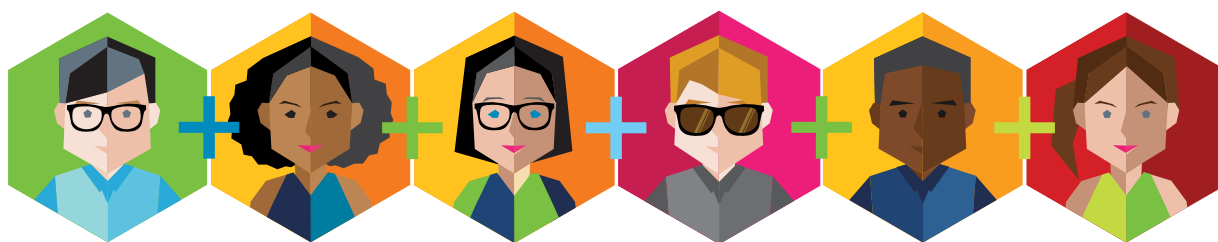
According to Judit Moscovitch, Professor of Mathematics Education in the Education Department at the University of California at Santa Cruz, research suggests that students benefit when classroom instruction allows bilingual students to choose the language they prefer for arithmetic computation. She and other researchers find that bilingualism shouldn't be viewed as a deficiency, but rather as another way to process information and communicate mathematical ideas.¹⁴



Myth: “Math isn’t language dependent”

Fact: A respectable body of research indicates certain kinds of language may cause difficulty for ELLs in mathematics.

While many mathematical formulas and notation have general conventions that enable international communication regardless of a student’s specific spoken language, it is often tempting for teachers to think that learning math in English should therefore be easier for all ELLs. That belief affects educational policy,¹⁵ and many schools routinely recommend that bilingual students be placed in math as their first mainstream subject. In reality, even though mathematical computation and other mathematical learning outcomes are sometimes less language-dependent than in other subjects, ELLs can still encounter difficulties.



Research indicates that math is far from nonverbal although it does have its own unique language that must be learned to be understood. For example, many English mathematics terms have multiple meanings, such as “compose” or “difference.” Some English words are specialized, like “coefficient,” and because they don’t arise in everyday conversation for many students—including ELLs—it can be challenging to acquire the vocabulary both because of infrequent use and limited context. Barriers to understanding are more prevalent as students also have to solve word problems that have idiosyncratic phrases or unfamiliar cultural contexts.

Teachers should always build from what students have in common. For example, the equals sign (=) is a consistent convention that ELL students are familiar with. For students who have learned math in another country, they may find that some familiar symbols, expressions, and methods are different in the U.S., and therefore ELLs should be invited to communicate their own solution strategies so that all students in the class are able to make connections between different solution strategies. They’re also likely to see how the same mathematical work can be written and represented in a different way or following different steps.

One idea is for teachers to review vocabulary that is specific to the language of math and clearly explain each term, even when ELL and non-ELLs share a classroom. Another is to provide visual supports, such as virtual manipulatives, because these representations connect all learners with the underlying mathematical concepts. A third classroom strategy is to provide students with access to bilingual materials and to encourage dialogue in Spanish between peers when possible. And while technology isn’t the right tool for every learning outcome, online resources provide a safe, engaging way for ELLs to take risks, make mistakes without fear of judgment or embarrassment, and work at their own schedule and pace.

2 SET HIGH EXPECTATIONS WITH A RIGOROUS CURRICULUM: *With Latino ELLs, educators should hold high expectations for every student, work flexibly to meet individual student needs, and avoid adopting a deficit model of student performance.*

NCTM and U.S. Department of Education researchers Eugene Garcia and René Gonzalez recommend teaching to a rigorous, standards-based curriculum and never lowering expectations for ELLs even though additional time and instruction will likely be required. They also suggest that students are best equipped to meet and exceed math expectations when they are provided with abundant and diverse opportunities for speaking, listening, reading, and writing as their teachers encourage them to take intellectual risks, construct meaning of math concepts, and seek reinterpretations of knowledge within compatible social contexts to make better sense of mathematical ideas.¹⁷

Experts assert that new math standards may require stronger cooperation between math teachers and schools' ELL specialists. Because of greater language demands, ELL specialists should spend more time working across content areas.¹⁸ This partnership is an example of how the increasing rigor of math standards enables deeper conceptual understanding while naturally supporting the growth of language skills.



ELLs and teaching to Common Core State Standards for Math

Judit Moschkovich, University of California, Santa Cruz outlines best practices¹⁹:

- ✓ Teach for **conceptual understanding**
- ✓ Use and **connect multiple representations**
- ✓ **Show and describe meaning** for symbols
- ✓ **Share, refine, and critique** student reasoning
- ✓ **Use language** to do math
- ✓ Engage in the **8 CCSS Math Practices**²⁰

3 USE VISUAL CONTEXTS AND MANIPULATIVES: *Using manipulatives, including virtual manipulatives, to teach elementary mathematics is an effective, researched-based best practice.*

*The Journal of Instructional Pedagogies*²¹ recommends the use of visual support to make language and mathematics more comprehensible for Latino ELLs. For example, a lesson about fractions using manipulatives is more understandable than a lecture or explanation of the concept. Manipulatives can be used to teach a wide variety of math topics. As students use manipulatives to make sense of mathematical ideas, they are also learning objectives from the NCTM standards²² related to problem solving, communicating, reasoning, connections, and estimation.

Visual math manipulatives help students with limited English proficiency develop deep understanding of concepts and skills through multiple modalities, which promotes problem solving and critical thinking. Virtual manipulatives, like the ones that are an integral component in DreamBox Learning Math, have the added advantage of enabling new types of engagement and promoting self-directed learning in a highly interactive, digital environment.



4 IMPLEMENT PERSONALIZED, INDIVIDUALIZED, AND BLENDED MODELS: *Leveraging anytime, anywhere, self-directed learning with the support of technology in and out of the classroom is a powerful way to increase access and provide equal access to quality education.*

Combining face-to-face instruction with online learning has yielded strong results as an education strategy. A 2010 study from the U.S. Department of Education²³ demonstrated that blended learning classes produce statistically better results than their face-to-face, non-hybrid equivalents. When education technology uses pedagogically sound approaches and curriculum materials, it can increase the individualization of each student's learning experience. Technology support also allows teachers to expand and more strategically use the limited time they have as facilitators of math learning for ELLs. This powerful approach can be leveraged to create the additional time required to meet Latino ELL needs.²⁴



Another reason to leverage mathematics technology programs is that Latino ELLs can be highly mobile, depending on their family circumstances. In addition, they might enter the U.S. school system at any grade and any time during the year. Some students enter U.S. classrooms with limited experience in formal school settings as well as with inadequate understanding or prior knowledge of grade-level math skills. Technology-based math programs that assess and adapt to the proficiency level of each student can more formatively support learning and thereby raise academic achievement of ELLs, regardless of academic or economic background. For schools that are trying to meet the needs of all ELLs with limited time and resources, an investment in technology, particularly adaptive technology, can enable a more personalized blended learning model that meets the needs of all students.

5 USE ASSESSMENT THAT'S BALANCED AND DYNAMIC: *NCTM suggests that a best practice for ELLs in math is empowering them to demonstrate and explain their understanding in multiple ways.*

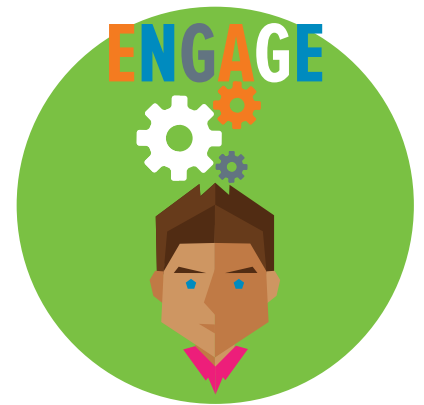
The type of ongoing, balanced assessment recommended by NCTM can be challenging in a single classroom that has a large number of both ELLs and non-ELLs. This best practice requires providing test accommodations that lessen the language complexity without reducing the rigor of the mathematics being assessed. Because Latino ELLs often have an incomplete grasp of academic math language, traditional tests often aren't able to provide a complete view of each student's understanding of math concepts. Often, ELLs know more math than they can demonstrate on traditional assessment instruments.



6 INCREASE ENGAGEMENT AND MOTIVATION: *Lessons and classroom experiences that require active involvement can motivate ELL students and engage them in the learning process. Connections to authentic and meaningful contexts help them understand concepts and acquire skills more easily.*

NCTM recognizes that making curriculum engaging and accessible to all students is important, and the organization includes this requirement in their position statement on mathematics for language minority students.²⁶ One way to improve engagement is to drive greater oral participation for ELLs in math classes. Improved verbal communication in mathematics is not only a way to demonstrate conceptual understanding. It also has the additional benefit of promoting language-learning overall. “This is not just an ELL issue,” said David J. Francis, a psychology professor at the University of Houston and the director of CREATE, which is based at the university. “It’s for all students who are academically at risk. Many will benefit from building of academic language and background knowledge through oral language.”²⁷

In addition to physical and virtual manipulatives, another way to drive active engagement is to use game-like environments that help learners develop problem-solving skills and persistence. In game-like environments, students can earn incentives and rewards for both achievement and effort. For many students these same elements are found in non-educational games, and are valuable techniques that support student persistence and progress. Given that some Latino ELLs might need additional learning time to catch up, these integrated gaming and rewards systems can help motivate ELLs to persist, continue learning and practicing, and explore math concepts in a supportive and rewarding environment. As educators work to increase ELL engagement and achievement in mathematics, we need to continually test and evaluate new approaches that will reach all students.



CONCLUSION

Accessing Understanding

When math is taught effectively, all students learn important vocabulary and language skills. For Latino ELLs, an equitable math education is a pathway to help them grow into English-proficient learners and successful bilingual students. The most important prerequisite to reaching, teaching, and closing math gaps is to first see elementary and middle school Latino ELLs as mathematical “thinkers and doers” who bring their own rich experiences and abilities to the classroom rather than as learners who come into the school with a deficit because their home language is Spanish.

DREAMBOX LEARNING® MATH IN ENGLISH AND SPANISH FOR K-8

With DreamBox®, teachers can decide when it's most appropriate for an individual student to use English or Spanish to understand or complete their math lessons. It's an approach that helps close gaps by providing students with a deeply personalized, culturally appropriate, Spanish-language experience. ELLs and students in Dual Language Immersion programs benefit from the same rigorous curriculum, equal access, and scaffolded support that builds deep math understanding and enables all students to reach high standards—in the language that works best for them.

- ✓ Bilingual Spanish–English: teacher-controlled ability to choose the language for each individual student
- ✓ Rigorous curriculum: supports the CCSSM and other U.S. and Canadian standards
- ✓ Assessment: ongoing, balanced, and dynamic assessment provides continuous feedback to students and detailed reporting for teachers
- ✓ Individualized: adapts continuously to each student's strategies and solutions, and adjusts pace and placement to support progress and proficiency
- ✓ Provides visual contexts: more support to help build comprehension through sense-making and manipulative interaction
- ✓ Engaging environment: age appropriate and game-like, offering rewards and achievements; increases engagement and persistence

To learn more about how DreamBox Learning® partners to support Latino ELLs in math, visit: [DreamBox.com](https://www.dreambox.com)

Download the infographic and share: [DreamBox.com/blog/latino-ell-infographic](https://www.dreambox.com/blog/latino-ell-infographic)



REFERENCES

- 1 https://nces.ed.gov/programs/coe/indicator_cgf.asp
- 2 <http://www.pewhispanic.org/2008/02/11/us-population-projections-2005-2050/>
- 3 <http://www.migrationpolicy.org/research/top-languages-spoken-english-language-learners-nationally-and-state>
- 4 <http://www.pewresearch.org/fact-tank/2014/08/18/u-s-public-schools-expected-to-be-majority-minority-starting-this-fall/>
- 5 https://www.whitehouse.gov/sites/default/files/rss_viewer/WinningTheFutureImprovingLatinoEducation.pdf
- 6 <http://publications.nclr.org/handle/123456789/1270>
- 7 10 points = approximately one grade level in NAEP ratings.
- 8 <http://www.apa.org/pi/families/resources/school-dropout-prevention.pdf>
- 9 <http://www.ecs.org/clearinghouse/01/10/20/11020.pdf>
- 10 <http://www.nctm.org/Standards-and-Positions/Principles-and-Standards/Principles,-Standards,-and-Expectations/>
- 11 http://www.huffingtonpost.com/2013/11/25/spanish-speaking-teachers_n_4338605.html
- 12 <http://www.nctm.org/Standards-and-Positions/Principles-and-Standards/Principles,-Standards,-and-Expectations/>
- 13 *The Inclusive Classroom, Teaching Mathematics and Science to English-Language Learners*
- 14 http://ell.stanford.edu/sites/default/files/pdf/academic-papers/02-JMoschkovich%20Math%20FINAL_bound%20with%20appendix.pdf
- 15 http://www.huffingtonpost.com/2014/04/12/bilingual-education-programs_n_5138927.html
- 16 http://www.tc.columbia.edu/i/a/document/6468_Ofelia_ELL_Final.pdf
- 17 Garcia, Eugene E., and René Gonzalez. "Issues in Systemic Reform for Culturally and Linguistically Diverse Students." *Teachers College Record*, 96, no. 3 (1995): 418–31.
- 18 <http://www.edweek.org/ew/articles/2014/11/12/12cc-ell.h34.html>
- 19 <http://www.edweek.org/media/150116presentation.pdf>
- 20 <http://www.corestandards.org/Math/Practice/>
- 21 <http://www.aabri.com/manuscripts/10451.pdf>
- 22 <http://www.nctm.org/standards/content.aspx>
- 23 <https://www2.ed.gov/rschstat/eval/tech/evidence-based-practices/finalreport.pdf>
- 24 <http://blog.edmentum.com/blended-learning-effective-model-english-language-learners>
- 25 http://www.ncela.us/files/uploads/11/abedi_sato.pdf
- 26 <http://www.nctm.org/ELLMathematics/>
- 27 <http://www.edweek.org/ew/marketplace/products/spotlight-ells-classroom.html>



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