

Chapter 1

Thoughts, Stories, and *Consejos* (Advice) from ELLs and Their Educators

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- Chapter 1 Reflections (graphic organizer)
- Senior ELLs' Prezi Presentation (link to Web-based presentation)

We send you on your journey through this book by sharing with you the thoughts and experiences of English language learners (ELLs) and their teachers in K–12 classrooms. The term *English language learners* refers to students who are learning English as a second language. Our intent in sharing these excerpts is to give you some understanding of what ELLs think, feel, observe, and recommend regarding better ways to address their needs. In addition, we share with you the insights of some mathematics teachers about teaching ELLs. We invite you to engage with this chapter interactively, and we have placed a graphic organizer at www.nctm.org/more4u to guide you in reflecting as you read.

Voices of High School English Language Learners

The comments in figure 1.1 are from a Prezi presentation developed by a group of high school ELLs. Prezi is a Web-based presentation application; the Prezi presentation that we are discussing, “A Change Is A Comin,” is the work of senior ELLs in Rebecca Merkel’s class at Iroquois High School, Jefferson County Public Schools, Louisville, Kentucky. Although the students’ comments are not specific to mathematics, their observations, feelings, and recommendations are profound.

What ELLs Observe	How ELLs Respond
Teachers think they are saving us an embarrassment by not calling on us.	But not calling on us makes us feel invisible.
Teachers think they are doing us a favor by always grouping us together.	We like to work together, BUT WE NEED to work with all of our classmates.
Teachers avoid conflicts by ignoring students who tease us.	I can't ignore teasing. Address it.
Teachers give us identical assignments instead of accommodations for our needs.	We need accommodations to help us meet YOUR targets.
Teachers assume that when we don't raise our hands this means we don't need help. They also presume that help means translation.	We need your help—which can mean giving an example, explaining the question, defining the word, etc.

Fig. 1.1. Comments of senior ELLs in a Prezi presentation

The chart in figure 1.2 is taken from the students' presentation, which they introduced with the words, "We want acceptance and tolerance."

Reflection 1.1

Figure 1.1 shows the thoughts of students who have experienced the school life of an ELL.

What are your initial reactions? Are there implications that you can address immediately in your role as an educator?

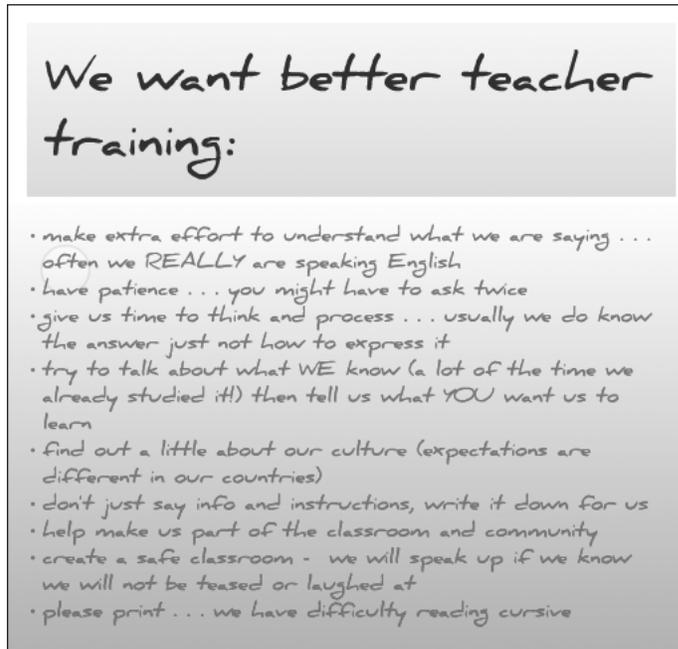


Fig. 1.2. Thoughts of senior ELLs from Rebecca Merkel's class, Iroquois High School, Jefferson County Public Schools, Louisville, Kentucky

Voices of College Students Reflecting on Their K–12 Classroom Experiences

Learning what college students say in looking back on their earlier experiences as ELLs in American classrooms can provide special insight. Consider the following perceptions of two Asian American students.

Jae-won Jang

When I first came to America, I really did not expect anything to be too different than before. The only things I knew that were going to be different were that I would be seeing Americans walking around and most of them would only speak English. Well, I could never have been more wrong. First of all, one thing that surprised me was how school worked. Because the school year in America and South Korea have different start and end times, I happened to end up going to school during second semester of fifth-grade elementary school when I had just finished fourth grade in South Korea. If that was not strange enough, I also found out that in America, most elementary schools end after fifth grade, unlike in South Korea, which finishes at sixth grade. So those were things that surprised me initially; then, when I started attending school, communication and a difference in culture caused me real problems.

At first I really didn't worry too much about not having knowledge of the English language before coming to the United States because I thought, "Oh, everything will

Reflection 1.2

Our role as teachers includes teaching English, even when our focus is mathematics.

How do you teach ELLs to listen, read, write, and speak in English without neglecting the mathematics but teaching it simultaneously?

Reflection 1.3

ELLs new to a school may arrive with a robust knowledge of mathematics.

Have you ever experienced this? If so, what has worked or not worked in your classroom? Based on this fact, what implications are there for you in your position?

work out somehow,” but I was careless. Because my English skills were at a kindergarten level, I basically did not speak at all for the first few weeks. During that time, my homeroom teacher tried to communicate with me using a book that had English words translated into Korean, and that worked to some degree, but even so, that did not teach me how to speak nor how to write. The only thing that was beneficial from that experience was I could understand English if it related to an object. Throughout my entire fifth grade, the only class I was able to participate in was mathematics. Since mathematics was something that did not require a lot of English skill, I was able to solve all mathematics problems without any difficulties. While learning mathematics, I also noticed that the stuff kids were learning was what I had already learned when I was in third grade in South Korea. So when I was able to do the problems, the kids were surprised since I knew everything without understanding a single thing that the teacher said. If I remember correctly, there were some projects for other courses that were given throughout the semester, but, of course, I did not do any of those projects due to my lack of English skills. So basically I should have gotten Fs for all of my classes besides mathematics, but the teacher gave me Cs for all of the other courses. I thought the teacher was being thoughtful because of my English skills.

So in the end, throughout my fifth grade, I did not learn anything about English from the teacher; how I was able to learn English, I believe, is through experience. Throughout my fifth grade, none of my teachers ever actually tried to teach me English, and they were satisfied communicating with me using a Korean book of translations. The way I learned English, I suppose, is that I tried to remember what people said in certain situations and then mimic what they were saying without knowing what it actually meant. For example, I remember when I was standing in the lunch line, I saw a kid asking, “Can I have that?” to the lunch lady while pointing to something, and I remembered what he said and thought if I say something like “Can I have that” and then point at the certain object, that would mean I’m asking a person that “I want what I’m pointing at.” So I didn’t know the alphabet or any grammar, but I remembered sentences and learned English that way. This method of learning became a problem later when I tried to write in elementary school and had to write essays in middle school. For example, this one time in our class was supposed to be quiet time, but this one girl kept talking to me, and I was trying to tell her to be quiet, but I did not know any words for it. Then, I recalled someone was saying something that sounded like “shut up” to another person and the other person became quiet, so I was thinking that if I say something like that, it would make her be quiet. Because it was quiet time, I realized I couldn’t speak, so I decided to write it down on paper with the alphabet and show it to her. With my alphabet book open, I wrote something that would match how “shut up” would sound (it was totally a wild guess). So I got to the point where I got “s h () t u p” on paper, but then I didn’t know what to put between the *h* and *t*. So I kept debating about which letter is supposed to go between *h* and *t*. During that time I did not know how the alphabet *u* sounded, and remembered seeing a word that had an *i* between *h* and *t*, so I inserted *i* trying to tell her to “shut up,” but instead I basically told her to “shit up.” This caused a huge misunderstanding. I made her cry, and I ended up getting into huge trouble with teachers, but this method overall gave me what I suppose was my “foundation” of English. So throughout fifth grade, the only course I was able to learn in was mathematics, and the only course I was able to learn through experience was English.

Reflection 1.4

ELLs often need tools to aid them in translations.

Are tools available in your school or classroom? How might you and your students gain access to these tools? Whom should you contact?

Reflection 1.5

According to the old saying, “A picture is worth a thousand words.” This is true for all learning but imperative for the learning of ELL.

Do you have pictures and diagrams in your toolbox ready to use when teaching mathematics concepts for understanding? If not, how might you fill this toolbox?

Reflection 1.6

Although it might be difficult or almost impossible to assess all students in their native languages, what might be doable in your setting?

Seung-eun Jang

I was born in Seoul, South Korea. I attended elementary school in Seoul until I was ten years old; then I moved to the United States with my mother. Although I could not speak any English then, the elementary school I attended in the U.S. placed me at a fifth-grade level with students in the same age group.

My schedule consisted of taking the same classes and participating in the same activities as other students, but during the few months of adjustment I also had a tutor who taught me how to speak basic English. I recall that during the first six months of elementary school I carried around a small electronic dictionary, which I referred to often whenever I had conversations with my teacher or fellow students. I also pointed out objects and people, and drew diagrams to communicate and learn English, as well as the school material. My classroom teacher, Mr. Ruiz [pseudonym], also had an English-Korean dictionary, which he frequently used during my few months of adjustment at school. He referred back to the dictionary less often as I became more proficient at speaking English. I feel that Mr. Ruiz’s effort to communicate with me helped me in many aspects of learning during my elementary school experience in the U.S. The dictionary I used not only helped me in learning English but also helped me in expressing my thoughts and ideas in mathematics and science, my favorite subjects.

Having confidence in my ability to reason in mathematics and science helped me adjust to a new school setting in the U.S. The learning pace in mathematics and science-related studies was faster in South Korea, so I was able to contribute more in those classes. For example, every week we were assigned to work on a multiplication activity, and I finished first most of the times. If any explanation was needed, I drew diagrams and pictures. Mr. Ruiz once asked the class, “Can anyone tell the class how water boils?” During this period of time, I was able to listen and comprehend English very well, but still had trouble expressing myself by using language. Because I had already learned the concept of boiling water in South Korea, I raised my hand. When Mr. Ruiz called me to answer, I walked up to the class to draw a pot of boiling water and arrows to demonstrate the flow of the heat and the foundational concepts of boiling water.

Learning elementary mathematics in South Korea and the U.S. were similar in some aspects, as both were composed of working and solving problems from a book and required some memorization. Just as it was in South Korea, in U.S. elementary school, I learned the same material and did as much work as other students, since there weren’t any higher or lower levels of mathematics class until I was in middle school. Also in both countries, I had the same group of classmates for all of the subjects taken in elementary school.

The main differences were the way teachers taught mathematics in class. In South Korea, the teacher was always standing at the front of the class by the chalkboard, while the students worked independently facing the teacher. In the U.S., Mr. Ruiz was more interactive with his students and arranged the seats differently every once in a while. We also didn’t have assigned seating in my U.S. elementary school.

As a learner of mathematics, I felt somewhat hindered in my ability to learn in my U.S. class. Since the learning pace was different, I had already learned the material a year before in elementary school in South Korea. However, I also feel that because of the edge that I had in mathematics, I had more time than I would have had to adjust to a new school as a foreign student. I wish that ESL mathematics classrooms would assess

and consider foreign students' knowledge of subjects other than English. The students from foreign countries come from different backgrounds, so their knowledge of subjects such as mathematics and science may be behind or ahead of the rest of the class.

Voices of Adults Reflecting on Their ELL Experiences

The recollections of adults can help us extend our understanding of the experience of learning a new language and a new culture while attending school. Below we offer three adults' reflections.

Reflection 1.7

Many ELLs don't look, talk, think, or act like the majority population.

What have you done or could you do to ease an ELLs' transition to a different school culture?

Reflection 1.8

As educators we must be aware of our pronunciation.

How might you be more cognizant of this on a daily basis?

Reflection 1.9

ELLs need advocates in schools.

Do you know your ELLs well enough to advocate for them?

Reflection 1.10

A caring teacher is concerned about students both mathematically and personally.

What actions do you take to show that you care about ELLs' development?

Sylvia Celedón-Pattichis

I was born in Salineño, Texas, and raised in Miguel Alemán, Tamaulipas, Mexico—two small towns along the border—from birth to age 8. I went to elementary school up to third grade in Mexico. My parents obtained a visa to move to the United States in the mid-1970s. When we moved to California, I was placed in fourth grade; I was very fortunate that I was not placed in a lower grade level because I did not know English. When I first stepped on the school grounds in California, I remember distinctively the different ethnicities represented—Asian, Mexican American, African American, and others. In Mexico, I was used to seeing people who looked like me. I had to adapt to a new culture, a new language, and a new way of thinking about things in California.

My strengths were mathematics and Spanish. When I went to school in Mexico, I was exposed to fractions and problems involving different numbers and operations. In California, we were doing a lot of basic operations, and the mathematics content was not as challenging for me. However, I do recall not comprehending word problems when those were introduced without illustrations. I also remember learning English by listening to the teacher pronounce the words, and then I would repeat the words to myself, using inner speech and saying the words silently. To memorize the spelling of a word in English, I would sound out the word in Spanish. For example, if I saw the word “multiplication,” I would say to myself “MUL-TI-PLI-CA-TION” in Spanish. This eventually helped me master the spelling tests we took each Friday in school.

Because I did not speak English, I was immediately assigned the label of “English as a second language” (ESL) student. This label followed me until ninth grade, when my ESL English teacher, Mrs. Barbara Osuna, gave me the opportunity to try a college prep English course. She was a true blessing in my life, and I still thank her for having made such a big difference in my life. Without that opportunity to try higher-level courses in English, my placement as an ESL student would have continued, as is the case for many English language learners in this country. This powerful move of changing my placement to an English college prep course not only afforded me the opportunity to enroll in higher-level mathematics courses and all other content areas, but it also opened doors for me to enroll in a university. By the time I was in ninth grade, I had a better command of English, but I would still make mistakes with verb tenses, especially those involving irregular verbs.

Mr. Sabas Osuna, the husband of Barbara Osuna, taught me pre-algebra in ninth grade and calculus in twelfth grade. He and other mathematics teachers have influenced my career path as a mathematics and bilingual teacher educator. Mr. Osuna *listened* to us and *cared* about us. At the same time, he kept the mathematics content at a very *challenging* level. I remember what was unique about Mr. Osuna's classes was that he would open

Reflection 1.11

Assignments for students need to be both mathematically meaningful and challenging.

How do you ensure that the tasks you assign to ELLs meet these criteria?

Reflection 1.12

The educational system can be difficult to understand or navigate.

What role do you take in forming relationships to guide families in gaining access to college?

Reflection 1.13

ELLs often come to the U.S. because parents want a better life for their children, even though this means leaving loved ones behind.

How do you acknowledge and address parents' interest in what is best for their children?

up the first few minutes of class to discuss any issues that were of concern to us. Many of my classmates were only 14 years old, and we were trying to figure out many things in life. He often offered us *consejos* (advice), and we all listened carefully to his advice. When he was ready to begin his mathematics lesson, we were then ready to listen to him and to engage in doing mathematics. Mr. Osuna asked us questions frequently throughout his mathematics lesson, making sure that we understood the content that was presented and offering examples of different ways or shortcuts to solve problems. He also set up games on Fridays to review the mathematics concepts that we had learned in a given week. His homework usually involved five problems that captured everything he wanted us to know from that day's lesson; these were very challenging problems.

Mr. Osuna's caring was evident throughout my high school years but especially my senior year. During that year, he continually asked me what I was planning to do in the future. I was enrolled in his calculus course, and I was unsure about what I would do. Being the oldest in my family and also having been part of my father's family *conjunto* (musical group), playing an instrument since the age of 9, I felt a responsibility to continue helping the family financially. Mr. Osuna often raised questions about the probability of our *conjunto* making it to the top and how life would be different if I attended a university. My father encouraged me to go to college, but his concern was not being able to afford paying for my college education. Mrs. Osuna, who was a financial aid counselor during my senior year, offered to help with that matter. Mr. Osuna visited my father at home and managed to convince him that it was OK to let me attend the University of Texas at Austin, where I obtained all of my degrees.

My high school years came before the publication of *Curriculum and Evaluation Standards for School Mathematics* (NCTM 1989) and *Principles and Standards for School Mathematics* (NCTM 2000). However, Mr. and Mrs. Osuna, as well as other teachers I had in school, were implementing some of the ideas represented in these Standards, frequently having the students explore why things work or not. So, three important qualities of a good teacher, for me, include caring for, listening to, and challenging students.

Eddie Mosqueda

My road to college was not predetermined by my family background nor any other form of privilege. I was born in Los Angeles, California, and am the son of Mexican-origin immigrants who worked very hard and for long hours for very little compensation. Like many other immigrants, my parents often talked about saving enough money so that one day, my family could return to Mexico to reunite with our extended family. When I was six years old, my parents decided it was time to fulfill their dream, so we relocated there.

In Mexico, I enrolled in school in the first grade. Although I had completed kindergarten in L.A. and was starting to learn English, it was in a Spanish-speaking context that I learned to read and write. My teacher in a small town in Michoacan, Mexico, had very high expectations for me and all of my classmates. In fact, I remember we had to learn our multiplication tables up to twelve times twelve. However, when I was halfway toward completing my second-grade education, my parents decided to return to the U.S. because they found it difficult to maintain financial stability in Mexico.

Upon my return to the U.S., I continued my education in the second grade. I was in an English-only context, so I had little to no understanding of what my teacher was saying. My elementary school had an English as a second language (ESL) pull-out program. So I would leave class to work with a language teacher on learning basic English words

Reflection 1.14

Non-ELLs have privileges that ELLs do not have.

Can you identify some of these privileges? How do you think these privileges affect the trajectory of ELLs' mathematical experiences?

Reflection 1.15

Often ELLs are pulled out of their classes to learn English.

What actions can you take to ensure that students have access to and gain an understanding of the mathematics content that they miss?

Reflection 1.16

What we do as educators can have lasting effects on students.

Do you continually observe and evaluate ELLs' strengths and take actions to give them opportunities that will enhance their mathematical experiences?

for about one hour per day. Although I felt that I was learning English, I often felt lost in class because I had missed out on what my classmates were learning while I was in ESL. Although learning English and content simultaneously was challenging for me in most content areas, I really enjoyed doing mathematics, particularly because the level of mathematics in the second grade focused on mathematics skills I had learned in the first grade in Mexico. As a result of my early arithmetic preparation in Mexico, I always did well in mathematics in the U.S.

Unlike my elementary school, where all of my peers were exposed to the same level of content, the middle school I attended tracked students into general or college-preparatory curriculum. I had been placed in the general track, along with most of the students from my elementary school. Toward the end of my seventh-grade year, my mathematics teacher insisted to the other mathematics teachers that I take the algebra readiness test. Because I earned a high score on the test, I was placed in algebra in the eighth grade, which, by default, moved me to the college-preparatory content courses.

Although academic tracking is a persistent source of inequity that typically disadvantages students with backgrounds similar to my own, I was one of the few Chicano beneficiaries of placement in the college-preparatory track in middle school and in high school, in spite of the fact that over 85 percent of the student population in the schools I attended was composed of Chicanos. Having the good fortune of being on the advantageous side of a mechanism that sorts students by "ability" was one of the primary reasons why I was able to attend college after graduating from high school. I also benefited from an outreach program sponsored through the University of California, Irvine (UCI), that sent undergraduate students to my high school to provide first-generation college students such as myself with information about meeting the prerequisites and guidance throughout the college application process.

As an undergraduate student at UCI, I was determined to make the most out of my opportunity to attain a college education. Although it initially wasn't clear to me what my career goal would be post graduation, my interests began to converge toward the end of my undergraduate years. I had worked every summer as a mentor and tutor with programs designed to prepare students of color for undergraduate majors in mathematics and science. Working in this capacity with undergraduate students allowed me to see how much I enjoyed teaching.

I always had my parents' unconditional support to study and do well in school. However, the high academic aspirations and expectations that my parents held for me were important but not sufficient to guarantee my success in high school. In fact, my family background, including my parents' level of formal education (my mother's fifth-grade and my father's first-grade formal education in Mexico), would indicate that I probably would not graduate from high school. I also credit the "head start" in mathematics that I received in Mexico for my success in school.

Elsa Medina

Have you ever been stressed out when you read the word *merry-go-round* or heard the word *else*? It was during a physics exam that I could not stop thinking about the word *merry-go-round*; I did not know its meaning, and it was on one of the questions. Because of this, I could not understand how to solve the problem. This was at a time when I was still learning English, and I was too embarrassed to ask the teacher about the meaning of the word. I came to the United States at the age of 17. As I was going to school, I had

Reflection 1.17

ELLs at beginning proficiency levels experience high levels of stress.

What linguistically sensitive actions do you take to engage ELLs in learning mathematics?

Reflection 1.18

Oral and written instructions are necessary for ELLs' comprehension and language acquisition.

What steps might you take to ensure that providing instructions both orally and in writing becomes a norm in your classroom?

Reflection 1.19

ELLs need time to process mathematical ideas in two languages.

How many different strategies do you have to give ELLs time to process information?

to sit in many classes where I did not understand a word the teacher was saying. What was worse, in many classes I was very stressed out thinking about the possibility that the teacher might call on me to answer a question. I remember many times I would panic when I heard teachers say the word *else* since my first name is Elsa and in English that word sounded to me very much like they were calling on me. To avoid having to speak in class as much as possible, I would sit in the back of the class and try not to make direct eye contact with the teacher. I never asked questions in class because I could not put a sentence together and also because most of the time I had given up trying to follow the instructor and resorted to taking notes and figuring things out at home with a dictionary or the help of a friend.

These feelings and experiences happened in most of my classes for a long time after coming to this country, but not in mathematics. I loved mathematics and still do. My mathematics classes were a safe haven for me because I could follow most of the lectures without understanding English. I knew when the teacher was solving equations, trying to find the point of intersection between curves, or integrating or differentiating a function, just to name a few, even if I did not understand all the phrases that teachers used as they performed these procedures. Of course, I had a lot of difficulty with word problems during exams, especially if there was no picture to help illustrate the situation. When it came to word problems, I had to resort to guessing what I was asked to do, given the context of what we had been doing, and usually I guessed correctly. I always wished the teachers in my mathematics classes, or in any other class, had written more of their instructions on the board to help me understand what I needed to do and to practice making sense of written instructions in class rather than waiting to see these instructions on exams.

For most people learning a second language, being able to read is easier than being able to speak. When we read, someone has already put the sentence structure in place to present ideas. When we speak, we have an idea that we want to communicate. This idea is probably in our native language and has to be translated, and we have to know how to put words together to make a sentence, to be able to pronounce the words correctly, and to do all of this within seconds. The mental requirement for speaking a new language is much higher than for reading in a new language. For this reason, I feel it would have been more helpful if my teachers had written complete sentences more often when presenting ideas in the classroom. But as I think back, I don't believe that many of my teachers even knew that I could not understand English, so why would they think of writing more to help someone like me? I don't think many knew of the stress levels I had just being in the classroom and the coping mechanisms I used to deal with that stress.

Understanding ELLs' Stories

The high school students from Rebecca Merkel's class have powerful messages for teachers regarding how they feel in class when a teacher makes certain moves. ELL students experience mixed emotions, including frustration, in the beginning stages of developing proficiency in a second language. The ESL seniors note the need for teachers to print rather than write in cursive. This is eye-opening for many of us in relation to the complexity of learning a new language and new content. The already demanding task of learning to read a new language is made even more complex by the need to read it

two different forms, printed and cursive. The type in all the textbooks that are used in schools mimics printed, not cursive, script.

Sylvia's and Eddie's stories both raise the issue of the frequent assignment of ELLs to lower tracks of education. Once students are labeled "English as a second language," or ESL, they often find themselves stuck with, and trapped by, that label for many years. Both stories point to the need to have teachers who advocate for ELLs at all times so that they are provided with more opportunities to learn rigorous mathematics content and to move out of lower levels of education. Jae-won's and Seung-eun's stories inform us about the experiences and challenges of learning English as a second language, the former recounting an experience with a teacher who may not have provided enough support and the latter recounting an experience with a teacher who took an interest in helping the student succeed in class. Seung-eun's teacher, Mr. Ruiz, found ways to position her as a competent student in the class by having her illustrate her thinking at the board with drawings and pictures involving the concept of boiling water during the beginning stages of language development.

Elsa's story clearly shows the challenges of learning English as a second language and the coping mechanisms that Elsa used to survive in this setting. In addition, Jae-won, Seung-eun, Eddie, Sylvia, and Elsa all indicate that they may have been covering mathematics content that they had already learned in other countries, an issue that is evidence of the frequent misplacement of ELLs in the U.S. schooling system. Although all of these students referred to strengths and success in mathematics because the subject matter has less reliance on the English language, current requirements of explaining, writing, defending, and conjecturing in the mathematics classroom pose different challenges for ELLs.

Voices of Teachers

Those who teach ELLs offer another important perspective. Consider the views of the following three teachers. In the first account, note that "sheltering the language" refers to making the language accessible by using various strategies with the intent of helping the student learn the content.

Reflection 1.20

Making meaning of mathematical ideas is critical in a classroom.

What strategies do you use to make content comprehensible?

Edna Alvarado

When a researcher asked Edna, a kindergarten teacher in a bilingual school, to make recommendations to teachers who want to engage their ELL students in problem solving, she said, "Definitely with lots of manipulatives, with a lot of extra practice, a lot of visuals. I would do a lot of whole-group explanations before we go to the little groups, so kids can give light to each other, and a kid that is a little more advanced in English than the other ones can help them too. Sometimes you teach in English, and they translate in Spanish by themselves or with partners. If you don't have access to the student's language, then you will need to rely on a lot of practice, a lot of repetition, lots of visuals, and gestures. And definitely you need to shelter the language and discuss the context of problems because if the kids don't understand what you are asking, if they don't understand the vocabulary, then their comprehensible input is like zero. They might imitate what other kids are doing, but they are not developing that problem-solving skill in their brains; they are not developing the concept."

Reflection 1.21

ELLs need champions—individuals who support their mathematical and language development.

Do you know who the champions are in your school or district? How can you collaborate with these individuals to make a difference for ELLs?

Reflection 1.22

Although teachers might not share the same language as their ELLs, it is important to build trusting relationships with students.

How do you develop these relationships in your classroom?

Reflection 1.23

Engaging ELLs by using multiple modalities that include communication is imperative.

How do you support ELLs as they communicate their mathematical understanding?

Bob McDonald

About seven years ago, a teacher and the principal came to meet with me to ask if I would become the Title I mathematics teacher. This meant that I would need to leave my present team and join the team of teachers who taught English language learners. The seventh- and eighth-grade students would be grouped into two classes, with the level determined by language ability rather than grade. One class would have students at emergent, pre-emergent, and basic levels, as defined by my state; the other class would be composed of students at the intermediate level. The charge from the district and state was to have these students learn English, but my principal wanted them to also learn mathematics so that they would not be too far behind when they left us and went to high school. I live in an English-only state, so the fact that my proficiency in Spanish is minimal was not too much of a concern to the principal. I did not have a bilingual endorsement and had not yet taken the soon-to-be state-required sheltered English instruction classes; those facts could describe the entire math department at my school at that time. My principal felt that I related well with students and that my past experience made me the teacher best suited for the task.

At that time, the school where I taught had about 1400 students in grades 6–8. Over 85 percent of the students were Hispanic and over 90 percent received free or reduced-price lunch. There were few teachers of color on the staff. The newly formed team would consist of two Latina teachers and myself. It was to be an interesting and challenging experience.

The students were a very energetic, close-knit group, and very proud of their Mexican heritage. One of the many challenges I had was to create an environment that would encourage participation by the students, in a language in which they were not proficient, taught by a teacher who looked different from them and did not speak their language. This was an ongoing challenge, since the students needed to see I was “for real” in my concern for them and their education. This continuous process sometimes went well and sometimes was frustrating to myself and to the students.

I learned that lessons that had the students actively involved and using manipulatives were better received and had more student engagement than a “traditional” lesson. I remember one of the first lessons required creating various rectangles that had a common perimeter and examining how the areas would change depending on how the perimeters changed. Getting the students actively involved in groups of four and creating the shapes out of large grid paper worked better than my first attempt at having the students at their desks working alone or in groups of two. I was fortunate to have some good English-Spanish mathematics dictionaries, which were helpful to the students who were proficient in reading in their native language. I also quickly discovered a website that had Spanish-English math cognates.

From my involvement with an NSF-funded urban systemic initiative and a middle school curriculum project, I had a number of good, engaging lessons that called on students to build, record, draw, and explain what we were working on, activities that theoretically take the student from the concrete to the pictorial and abstract levels. But like many middle school students, the ELLs were at varying places in their mathematical development, as evidenced by their proficiency with addition, subtraction, multiplication, and division facts. So my lessons flipped back and forth between skills and applications. I made use of the strategies that I knew about—long wait time, gesturing, and color

Reflection 1.24

Developing presentation skills is an ongoing process for ELLs.

How do you scaffold presentation requirements to facilitate students' growth throughout the year?

coding my work on the board to make it stand out more for the students. My efforts to ask probing questions of the students who were stuck were often “lost in translation.” I compensated for this by letting one person from the group be a “spy,” visiting other groups if they were not making progress. Obviously, because they were teenagers, the talk in groups was not always about mathematics, and my lack of Spanish made it difficult to be certain whether the students were on task. There were times when my requirement that the talk “be about the math” had a negative effect on the environment that I was striving to create.

Toward the end of the first year, the students began to give good presentations of some “big” problems, with all group members having some verbal part in the presentation. Part of the presentations included asking if there were any questions, and there were instances when the students got into some good mathematical discourse.

It was a challenging but rewarding two years. At times I left school happy, knowing I had reached my students; at other times I was frustrated, wondering where and why the day took a detour to rocky ground. As I was unpacking my boxes in a new room for a new five-person ELL team the next year, I found a small whiteboard written on with a permanent marker—a thank-you note in the form of an acrostic poem that touched my heart and brought a few tears to my eyes.

Reflection 1.25

ELLs need to use their own language to access mathematical concepts while simultaneously developing facility within the English language.

What tasks do you pose that explicitly address this simultaneous learning?

Matthew S. Winsor

Even teachers who speak a second language may still face a daunting task in teaching mathematics effectively to ELL students. I was one of those teachers. From 1995 to 1999, I taught at a high school in Southern California where the student population was 56 percent Hispanic. I spoke Spanish and was hired in part to teach mathematics to ELL students. I taught my classes in English. My school had no materials to use in an ELL class with Spanish speakers, and I could not find a textbook company that offered such materials. I was also not eager to spend enormous amounts of time trying to translate mathematics texts.

As a result, I began a quest to find ways to help ELLs learn mathematics. My initial thesis was that the main barrier for these students was learning mathematics in their new language. I decided to look at research regarding both how one learns a new language and how one learns mathematics, thinking that I could use any similarities between the two bodies of research to come up with a teaching method. After synthesizing the research, I created an approach for teaching ELL mathematics that I called Mathematics as a Second Language (MSL) (Winsor 2007, pp. 372–73). The main components of MSL were vocabulary activities, journals, group work, and projects. One central vocabulary activity was word squares (see Quinn and Molloy [1992]), each made on a 3-by-5 card divided into four quadrants—one for students to write the mathematical term in their own language; a second to write the term in English; the third to write a definition in their own words, which could be in their native language; and the last to include a representation of the concept. Students used their word squares throughout the year and often in the mathematics classes the following year. When students worked in groups, I found that students who were more fluent in English had the opportunity to help peers who were less fluent. While the more fluent students gained a deeper understanding of the mathematics, the less fluent students had the advantage of reviewing the mathematics content with someone who spoke their native language. My students wrote in their journals in the language they were most comfortable with, but they were required to

write the mathematical terms in English. I found that this helped students associate the English term with the mathematical concept already in their minds in Spanish. Students' first journal entries were often unsophisticated, relying on nonmathematical terms to express their ideas. As the year progressed, their journal entries became more mathematically precise, and the use of English in their journals increased. Students worked on projects in groups, with the goal of presenting their results orally to the class. When students worked on their projects during class, I would circulate around the classroom and talk to them about their work, questioning them about their ideas and decisions. This gave students the opportunity to express their ideas to me before they presented them to the class.

I recognize that there are many teachers who teach ELL students and may not be aware of the resources available to them. One resource is an ELL student who is fluent enough in English to help other ELL students understand the teacher. Another resource is mathematics glossaries that have mathematics terms in both English and the ELL students' native language. A third resource is instructional assistants who speak the student's language (I met regularly with the bilingual aide, so she was familiar with the goals of MSL and knew how I wanted students to work in my classroom). A fourth, and often underused resource, is foreign language teachers, who have been trained to teach others a new language and can share strategies that can be adapted for a mathematics classroom. Also, learning to speak the language of the students enough to greet them and ask how they are goes a long way toward gaining their confidence. And finally, when you show ELL students that you care about them, they will trust you more and work harder with you (Winsor 2007).

Understanding Teachers' Stories

Matthew and Bob discuss the fact that teaching mathematics effectively to ELLs involves hard work. Both teachers refer to the need to seek resources, such as English-Spanish dictionaries. In addition, these teachers comment on the progress that they noticed from the beginning to the end of the school year regarding their ELLs' ability to give explanations that were mathematically precise. Both of these teachers also comment on the importance of the students' recognizing that they (the teachers) had a genuine interest in the student as an individual.

Edna and Bob recommend the use of manipulatives while students are developing mathematical language to communicate explanations. All three teachers mention the need for group work in the mathematics classroom to allow students time to process mathematical concepts. In addition, all three teachers are aware of the need to focus on teaching language as they taught mathematics content.

Matthew's story points to the need to see "teaching as a scholarly activity, not as a technical activity" (Aguirre and Gutiérrez 2011). In other words, teachers have to conduct research and find resources that will help them understand and teach ELLs. These resources also include collaborating with teachers who are certified to teach bilingual students or ELLs.

This chapter provides personal stories of struggles and successes from ELLs as well as stories from mathematics teachers of ELLs. In addition, both ELLs and teachers of ELLs offer thoughts, stories, and *consejos* to those committed to improving the mathematics education of ELLs. In the next chapter, we discuss stages of second language

development to understand issues that are specific to ELLs and provide descriptions of student actions and recommendations for teachers in the mathematics classroom.

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Chapter 2

Second Language Development and Implications for the Mathematics Classroom

by Nora G. Ramirez and Sylvia Celedón-Pattichis

more **4U**

- [Bridging the Language Barrier in Mathematics \(journal article\)](#)
- [Mathematical Notation Comparisons between U.S. and Latin American Countries \(chart\)](#)
- [Mathematical Notations and Procedures of Recent Immigrant Students \(journal article\)](#)
- [Mathematics Homonyms and Homophones \(chart\)](#)
- [Professional Teaching Standards—Discourse \(expectations\)](#)

Janice teaches a classroom full of English language learners (ELLs) who all speak the same language but a language that is different from her own. James has five newcomer ELLs who speak different languages. Savannah teaches one ELL, who feels isolated from her peers. If you were one of these teachers, how would you engage each of the ELLs in doing and understanding mathematics in your classroom? To guide educators who find themselves in similar situations, we provide strategies that help teachers so that ELLs can participate effectively in mathematics learning environments. We draw from three bodies of literature—mathematics education, second language development, and mathematics education of ELLs—as well as from practitioners’ effective strategies for teaching mathematics to ELLs.

Both research and practice have contributed to the various frameworks that exist for defining stages of second language development. For example, California has a framework that identifies five different levels of language development, whereas Texas uses four levels to describe the stages of language development. The Teaching English to Speakers of Other Languages (TESOL) *PreK–12 English Language Proficiency Standards* (Gottlieb et al. 2006) includes six levels. We use three levels based on the Sheltered Instruction Observation Protocol (SIOP) (Echevarría, Vogt, and Short 2007)—beginning, intermediate, and advanced—to help educators understand and meet the reading, writing, speaking, and listening needs of ELLs.

It is important to note that the levels of language development that we describe in the next sections are guidelines and should not serve to confine ELLs to a particular level. Moreover, teachers must understand that the divisions between language development levels are not well defined and that movement between the levels is usually not linear. Further, these levels of language development are not parallel to similar levels of mathematics learning. In other words, because a student is in the beginning stage of language development, it does not follow that the student has only a basic understanding of

mathematical content (Lesser and Winsor 2009). Therefore, teachers should always make instructional decisions on the basis of students' needs—what students do mathematically and how they communicate by using their first and second languages.

As ELLs develop proficiency in English as a second language, teachers should provide support that helps the students develop language that is specific to mathematics, sometimes referred to as *academic language* (Cummins 2000, 2003, 2008). Researchers argue that focusing on academic language alone may promote teaching vocabulary without a context or viewing the students as lacking because of their inability to use academic language (Edelsky 2006; MacSwan and Rolstad 2003). Rather than emphasize academic language, we choose to focus on making mathematical meaning in social contexts, with an emphasis on mathematics discourse. This requires that teachers and students create a mathematics discourse community (MDC) (Willey 2010), in which teachers interact with students and students interact with their peers to develop knowledge of the mathematics while using the language of mathematics. Using Gee's (1996) work, Willey conceptualizes MDCs as communities that "involve ways of being, thinking, and speaking that are unique to a mathematics environment" (Willey 2010, p. 4). "Regular and active participation in the classroom—not only reading and listening but also discussing, explaining, writing, representing, and presenting—is critical to the success of ELLs in mathematics" (Application of Common Core State Standards for English Language Learners 2010, p. 2). Some may think that the problem with academic language is big words, but we argue that it lies in shifting the focus away from understanding the mathematical meaning of concepts, knowing how to use precise mathematical language, and using terminology to explain and connect mathematical concepts. Thus, we move away from using academic language and instead choose to use mathematics discourse as a focus for teaching mathematics to ELLs. We define mathematics discourse as communication that centers on making meaning of mathematical concepts; it is more than just knowing vocabulary. It involves negotiating meanings by listening and responding, describing understanding, making conjectures, presenting solutions, challenging the thinking of others, and connecting mathematical notations and representations.

Guiding Principles for Teaching ELLs in Mathematics

Traditionally, second language development has consisted of listening, speaking, reading, and writing, all of which are directly related to the skills needed to meet the expectations of NCTM's Process Standards for problem solving, reasoning and proof, and communication (NCTM 2000). It is imperative that the remaining Process Standards, for representation and connections, also be a focus in teaching ELLs. Constructing viable arguments, critiquing the reasoning of others, and explaining and justifying mathematical thinking are critical mathematical practices (Common Core State Standards Initiative 2010). As NCTM (2008) states, "It is important for all students, but especially critical for ELL students, to have opportunities to speak, write, read, and listen in mathematics classes, with teachers providing appropriate support and encouragement" (NCTM 2008, p. 1). Having ELLs share their mathematical thinking positions them as *competent problem solvers*, and thus as *contributors of mathematical knowledge*, and places them on a trajectory for increased participation in the learning process (Empson 2003).

When we consider the Common Core State Standards and the NCTM Process Standards, we perceive the need—and accept the opportunity—to articulate some guiding principles that are specific for ELLs to engage in MDCs that foster learning rigorous mathematics. Consider the five principles below:

Guiding Principles for Teaching Mathematics to English Language Learners

1. *Challenging mathematical tasks:* Students at all levels of English language development need challenging mathematical tasks, made accessible through supports that clarify their understanding of the task. Although the tasks may be the same for all levels, the teacher actions required for students to have access to them and to communicate their understanding often differ at each level.
2. *Linguistically sensitive social environment:* Mathematical learning occurs in a linguistically sensitive social environment that takes into consideration linguistic demands and discourse elements (Chval and Chávez 2011/2012; Chval and Khisty 2009) and is characterized by teacher-supported, ongoing, high-quality interactions that include all forms of communication between teachers and students and between students and students.
3. *Support for learning English while learning mathematics:* Facility with the English language is acquired when ELLs learn mathematics through effective instructional practices, including support structures that scaffold students' language development, engage students in MDCs, make mathematics content linguistically comprehensible to them, and assess their progress in reaching predetermined linguistic and mathematical goals.
4. *Mathematical tools and modeling as resources:* Mathematical tools and mathematical modeling provide a resource for ELLs to engage in mathematics and communicate their mathematical understanding and are essential in developing a community that enhances discourse.
5. *Cultural and linguistic differences as intellectual resources:* Students' cultural and linguistic differences in the mathematics community should be viewed as intellectual resources rather than as deficits and should be used in the classroom to connect to prior knowledge and to create a community whose members value one another's ways of engaging in mathematics.

Teacher and ELL Actions Based on Stage of Language Development

To provide educators with useable information for classroom practice, we describe ELLs, specify effective actions of both students and teachers, and share vignettes of classroom interactions. We begin by describing teacher behaviors that are appropriate in any mathematics classroom with ELLs. We provide characteristics of ELLs at each stage of second language development to inform practitioners about the subtle and not-so-subtle differences among students at the various stages. We describe student actions to support educators in identifying, understanding, and responding to ELLs' needs. We then

include a list of specific teacher actions to engage students at each stage of language development in learning mathematics while simultaneously developing facility with the English language. We have organized these lists of teacher actions by connecting them to the guiding principles that we have identified for teaching mathematics to English language learners. These teacher actions encompass good teaching strategies, but they do more than that. The suggested instructional techniques are more than good teaching strategies; they are imperative to support ELLs in learning mathematics because they give explicit attention to the linguistic demands of a mathematics classroom.

Finally in this chapter, we present vignettes to invite the reader into a mathematics classroom to highlight explicit behaviors of ELLs and teachers. In addition, we provide specific examples by including links to video clips, vignettes, reflections, and mathematics lessons that exemplify the teacher actions and student actions at each stage of second language development. The reader can navigate these examples by going to the More4U website for this book as well as referring to suggested examples in other chapters. It is our intent that these research-based teaching practices and the linked examples will enable educators to support ELLs at all stages while challenging them intellectually and engaging them fully in the mathematics learning process.

Essential teacher actions with all ELLs

Some actions are imperative for teachers to use consistently with all English language learners in mathematics. The following list enumerates these indispensable teacher actions and indicates in parentheses the relevant guiding principles (e.g., P1: Challenging mathematical tasks). In addition, the cases of practice presented in chapters 5, 6, and 8, the videos and lenses described in chapter 12, and additional materials in more4u provide specific examples of these teacher actions.

An effective teacher of ELLs always does the following:

1. Uses challenging problems and provides access by—
 - a. assessing students' prior knowledge to determine ELLs' familiarity with the context of a task rather than assuming that ELLs are familiar with contexts and language that may be commonplace to others;
 - b. integrating culturally relevant tasks;
 - c. planning for the use of a variety of tools and mathematical models; and
 - d. focusing on students' understanding of both the mathematical and everyday language involved in the task by—
 - i. using strategies such as “acting it out” and displaying Web-based pictures or videos;
 - ii. explicitly addressing unfamiliar contexts and linguistic structures within the task (see chapter 12);
 - iii. using manipulatives, diagrams, models, and symbolic notations. (P1: Challenging mathematical tasks; P2: Linguistically sensitive social environment; P3: Support for learning English while learning mathematics; P4: Mathematical tools and modeling as resources; P5: Cultural and linguistic differences as intellectual resources)