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Supporting English Learners in STEM

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Introduction

In my teacher preparation courses at Bridgewater State University, I studied how to meet the needs of students with diverse backgrounds, readiness levels, and learning styles. During the Fall 2019 semester in particular, I had the opportunity to spend time in a grade 1 Sheltered English Immersion (SEI) classroom. In this classroom, all 25 students were English Learners (ELs). During my time in this classroom, I observed the teacher employ strategies to not only help the students achieve academic goals, but also to help build their confidence and learn American social practices. For example, every morning the class began with each student shaking another student's hand and saying, "good morning." This routine not only built a strong, welcoming classroom community, but helped the students practice their English. In this classroom, I was able to learn a lot about how to alter lessons to better serve EL students, how important teacher collaboration is, and also how important it is to acknowledge the students' diverse backgrounds and cultures. I taught seven math and science lessons in this classroom. Over time, I learned through experience the importance of things like visuals, hands-on activities, and repetition. It was an invaluable experience for me as an aspiring teacher to observe and practice these strategies to help ELs access STEM content.

ELs are a rapidly growing portion of the student population in America, and yet many teachers feel they are unprepared to meet their needs. It is estimated that one in four students will be from a household where a non-English language is spoken by 2025 (Stoddart & Mosqueda, 2015). Despite this, one study found that less than 25% of STEM teachers surveyed

had any EL-specific professional development. Additionally, none of the teachers in the study had participated in more than eight hours of EL-specific professional development (Besterman, Williams, & Ernst, 2018). Furthermore, the schools ELs often attend are underfunded and with high teacher turnover (Staehr Fenner & Snyder, 2017). These factors lead to ELs experiencing opportunity and achievement gaps, such as lower graduation rates and lesser enrollment in gifted programs (Staehr Fenner & Snyder, 2017). Clearly, it is vital that teachers are equipped with knowledge and strategies to better support ELs in the classroom. Teachers may help support EL achievement in the classroom by employing strategies to support them cognitively, as well as socially and emotionally.

Cognitive Supports for English Learners

English Learners may struggle with the often dense, specialized content language used in subjects like math and science, in addition to struggling with the language of instruction itself (Williams, Tang, & Won, 2019). This diminishes their opportunity to build critical language skills concurrently. That is why teachers should employ strategies to decrease the heightened cognitive burden faced by ELs in STEM lessons. STEM skills and language acquisition skills have a high instance of overlapping (Fathman & Crowther, 2006;, Williams et al., 2019). For example, classification is a science and math skill that is also important in language when sequencing events or ideas (Fathman & Crowther, 2006). Synthesizing information based on evidence is another STEM skill that is important in language when analyzing and making inferences (Fathman & Crowther, 2006). When students practice their STEM skills, they are also building language and literacy skills. Teachers may support ELs cognitively by using multiple modalities,

metacognition, and/or technology to increase access to STEM content and develop English language proficiency at the same time.

Multiple Modalities

The term "multiple modalities" or "multimodal" refers to the use of various forms of communication to make meaning (Williams et al., 2019). STEM content areas are inherently multimodal. Graphs, formulas, written explanations, and simulations are used in STEM fields to convey a more complete picture of one meaning (Williams et al., 2019). The use of multiple modalities to communicate STEM concepts in the classroom presents ELs more opportunities to make meaning. Furthermore, by modelling the using of multiple modalities, teachers may encourage students to participate in discourse using multiple modalities as well. Research has shown that during academic discourse, ELs often choose to contribute using alternate modes of communication, such as gesture (McVee, Silvestri, Shanahan, & English, 2017; Williams et al. 2019). When ELs are able to use multiple modalities of communication (such as gesture or diagram) to communicate their ideas, they are able to meaningfully participate and explore concepts more deeply (Sotomayor, 2013; Williams et al. 2019). They also are able to build stronger language connections to the content (Sotomayor, 2013). The use of multiple modalities may be called "productive communication," as it allows ELs to communicate and contribute in a meaningful way (McVee et al., 2017).

There are many strategies teachers may choose to integrate multiple modalities into STEM lessons. Visual scaffolds may both explain concepts and demonstrate understanding in a nonverbal way. They allow EL students to show what they know without relying exclusively on written or verbal language skills (Song, Higgins, & Harding-DeKam, 2014). These may include

things like graphic organizers and data tables (Song et al., 2014). Illustrating target vocabulary may also help ELs make meaning of unfamiliar written words. Including pictorial representations on word walls or glossaries of vocabulary words may be helpful (Fathman & Crowther, 2006).

The use of multiple modalities of communication is important, but it is the translation between these modalities that allows for meaning-making to occur (Williams et al., 2019). Lessons that involve students employing multiple modalities and translating concepts between them have been shown to lead to deeper understanding and more connections between concepts (Williams et al., 2019). A specific example could be a chart that defines a concept in multiple modalities in both of the student's languages as a way for the student to use the language they are more comfortable with to build understanding in English. For example, while teaching geometry, the teacher could make a chart that includes the name of a shape written in both languages, a drawing of the shape, a drawing of the shape as a real-world object, and a sentence written in English about the shape (Zhao & Lapuk, 2019). Using a graphic organizer like a chart to facilitate translation between two different languages and illustration is an effective means of supporting that student practicing the vocabulary and making connections in a meaningful way (Zhao & Lapuk, 2019).

English Learners strengthen their STEM language skills by translating between registers when engaging in classroom discourse (Fathman & Crowther, 2006; Lee, Llosa, Grapin, Haas, & Goggins, 2019). A register refers to the specific language used in association within a certain context (Lee et al., 2019). The specialized register of science or math involve a different way of using language than a conversational register. Over time, ELs are able to communicate in a

specialized STEM register at a more advanced and precise level than using conversational English (Lee et al., 2019). This growth happens when teachers employ strategies to ease ELs into using this specialized academic language (Fathman & Crowther, 2006). The "think-pair-share" model is a strategy that may move ELs gradually from their native language to academic English. During the "think" phase, students contemplate a prompt or a question on their own, perhaps first in their native language. Next, students pair up to discuss their thoughts on the prompt with a partner. Lastly, the whole class comes together as a group to discuss (Kelly, 2016). This process may be taken one step further by requiring students to write about the topic. Using this strategy, teachers may gradually assist ELs to move from conversational language to formal academic language (Kelly, 2016).

Academic language is most likely not a register commonly used by elementary level ELs (Fathman & Crowther, 2006). There are scaffolds teachers may use to familiarize ELs with common vocabulary used in academic discourse and provide them with more accessible ways to participate (Kelly, 2016). Providing explicit definitions of targeted academic vocabulary (such as analyze, investigate, and infer) may help ELs in academic discussion (Fathman & Crowther, 2006; Kelly, 2016). Sentence frames or language stems may also assist ELs in using academic language. They provide sentence structure while also allowing the student to express their ideas (Fathman & Crowther, 2006; Kelly, 2016). These tools have been shown to lead to students engaging in discourse using an academic register more independently (Kelly, 2016).

Text re-presentation may also be an impactful strategy to increase EL comprehension of STEM content (Fathman & Crowther, 2006). When a lesson introduces a large amount of dense content language, teachers should speak slowly and clearly while stopping frequently to check

for understanding (Fathman & Crowther, 2006). They may also re-phrase or summarize information using simpler language (Fathman & Crowther, 2006). Additionally, they may communicate the information in another modality, such as pictures or gestures (Fathman & Crowther, 2006). Likewise, the students could re-present the text in a different modality to achieve a deeper understanding and exercise different skills (Fathman & Crowther, 2006).

Metacognition

Metacognitive strategies may be effective tools for ELs to make gains in STEM. These strategies include recognizing cognates, code-switching, reciprocal teaching, and goal setting. Metacognitive strategies help students think about their own thinking process, and may be used in combination with each other (Fathman & Crowther, 2006). ELs may benefit from explicit instruction of these strategies. Recognizing cognates may help ELs make meaning of unfamiliar vocabulary (Song et al., 2014;, Zhao & Lapuk, 2019). For example, there are multiple languages that use the prefix "tri-" to indicate three. An EL who speaks Portuguese and is unfamiliar with the word "triangle" might make the connection to words in their native language that also have this prefix. The student may make this connection themselves when encountering a word in English that has the same prefix as a word they know in their native language, or the teacher could utilize online translation software to find meaningful words in the EL's native language they could use to associate with new vocabulary. They could then infer that "triangle" refers to a shape with three sides (Zhao & Lapuk, 2019).

Teachers may also encourage metacognitive strategies that involve code-switching. Code-switching is translating from one language to another (Casey, Mireles, de Lourdes Viloria, & Garza, 2018). Combining code-switching with reciprocal teaching strategies has been shown

to increase EL comprehension of scientific text (Casey et al., 2018). Reciprocal teaching strategies include making predictions, asking questions, summarizing, and clarifying vocabulary (Casey et al., 2018). Code-switching may also be useful when combined with graphic organizers. For example, a double-entry journal may assist ELs to connect with math concepts more deeply (Zhao & Lapuk, 2019). A math double-entry journal is a T-chart with one side designated to solving the problem however the student wants to solve it, usually using their native language. The right side is for the student to explain their thought process in English (Zhao & Lapuk, 2019). Double-entry journals used this way have been shown to improve ELs' math communication skills (Zhao & Lapuk, 2019). Depending on the age and previous education of the student, they may or may not already be able to write in their native language, and therefore may or may not be able to code-switch between written languages. If a teacher does not speak the student's native language and needs to translate material, they might utilize online translation resources or translators may be available for support in the school. Finally, it is helpful for teachers to promote metacognition in their ELs because self-assessment and goal setting are valuable tools for them (Fathman & Crowther, 2006). Setting clear goals helps ELs feel more in control of their learning, lessens anxiety, and is a way for teachers to keep track of their progress (Fathman & Crowther, 2006).

Technology

Technology provides teachers with more resources and opportunities to support ELs in the classroom (Brozek & Duckworth, 2011). It may be a successful way to lessen the cognitive burden on ELs. Firstly, online translation resources may be an effective way of making the classroom more accessible for ELs (Nemeth & Simon, 2013). Not only can content text and

classwork be translated, but teachers may utilize online translation sites to make their classrooms more welcoming. For example, an online translator may be used to create labels for classroom supplies in the EL's first language (Nemeth & Simon, 2013). Additionally, classroom technology may be a useful tool to support ELs. An interactive white board makes it easier for teachers to integrate visual supports like photos and videos into notes (Brozek & Duckworth, 2011). Notes written on an interactive white board may even be saved and referenced later, or even printed out and given to EL students (Brozek & Duckworth, 2011). ELs may then revisit lessons as many times as they need at the pace that they need (Sotomayor, 2013). Also, document cameras may be used to provide additional visual examples to ELs. For instance, a teacher could use the document camera to model using math manipulatives or science materials (Brozek & Duckworth, 2011). Teachers should take advantage of all the technology available to them in order to support ELs, whether that means equipment like interactive whiteboards or free resources on the internet.

Technology also provides ELs with more ways to express their learning (Brozek & Duckworth, 2011). Discussion boards have been shown to be beneficial for both the academic and social language development of ELs (Brozek & Duckworth, 2011). Students may post responses to a topic on an online forum. When ELs participate in this collaborative format, they are practicing using content vocabulary and academic language with their peers (Brozek & Duckworth, 2011). ELs may also utilize multimedia software to express what they know (Brozek & Duckworth, 2011; Nemeth & Simon, 2013). For example, ELs could use a computer program to make a movie or slideshow showcasing their learning, in place of giving a live presentation in front of the class. Speaking in front of the class may be difficult for ELs, so recording a

presentation using technology may give them the chance to write, check, and practice what they say to get their point across (Brozek & Duckworth, 2011).

Technology may also even the playing field for ELs, so teachers may better assess how much they know about the content (Sotomayor, 2013; Roohr & Sireci, 2017). Direct linguistic supports are commonly used in computer assessments to support ELs. An example of direct linguistic support would be simplified sentences (Roohr & Sireci, 2017). However, not all linguistic supports are necessarily advantageous, and teachers should not assume that just because technology support is available to ELs that it is helpful to them (Roohr & Sireci, 2017). A study of both English-only and EL high school students showed that use of linguistic supports decreased over the course of the assessment, even for ELs (Roohr & Sireci, 2017). This indicates that interpretations of these test scores may not be as accurate as possible, if the assessors assume that the language burden on ELs has been sufficiently lessened (Roohr & Sireci, 2017). If using technology accommodations, teachers should be certain to find a way to assess how useful the ELs find those accommodations, without relying on the ELs themselves to bring it to their attention.

Any strategy employed with the goal of lessening the cognitive burden on ELs should provide more access points for them to make meaning of the material. Using multiple modalities of communication, metacognition, and technology has been shown to be an effective way of providing these additional entry points for ELs to access the content (Kelly, 2016; McVee et al., 2017; Sotomayor, 2013; Williams et al., 2019; Yocom de Romero, Slater, & DeCristofano, 2006). Teachers should guide ELs to think about their own thinking, and select

strategies and modes of communication that allow them to engage with the content on a deeper level.

Social and Emotional Supports for English Learners

Policies and practices surrounding ELs need to be research-based not only to help them succeed cognitively, but to help them develop and grow with positive self-image and social skills. Some programs in place for ELs have been shown to not only be inadequate, but damaging. A study from Arizona found that all eighteen children they followed in an English immersion program showed symptoms of emotional abuse (Parra, Evans, Fletcher, & Combs, 2014). These symptoms included anxiety, aggression, and damaged self-esteem, as well as feelings of guilt and shame (Parra et al., 2014). Disrupting ELs' healthy social and emotional development is unacceptable and eliminates opportunities for learning to happen. Anxiety and negative emotions have an adverse effect on learning (Fathman & Crowther, 2006). Students who feel safe in their classroom environment have increased motivation to learn and participate (Fathman & Crowther, 2006). By making ELs feel accepted, respected, and included in their classrooms, teachers may foster their engagement and success, and begin to minimize achievement gaps.

Teacher Attitudes

Teacher attitudes have a significant impact on EL learning (De Oliveira, 2011). Students want to feel as though their teacher cares about them and believes they can succeed (Fathman & Crowther, 2006). Teachers should do everything they can to learn about their diverse students' cultures and backgrounds and try to include them in the classroom. For example,

labelling science equipment or math manipulatives in English and in the native language of an EL may make a STEM classroom feel more welcoming (Fathman & Crowther, 2006). Also, highlighting STEM professionals and famous figures from diverse backgrounds may make EL students feel as though their teacher values their potential and contributions in STEM (Fathman & Crowther, 2006). Teachers also have the power to make their classroom more culturally aware and impact the attitudes of all students, not just ELs. Including multicultural literature or even some books in an ELs native language will not only make an EL feel more accepted, it will help the English-only students view diverse cultures as important contributors to STEM (Murphy, 2018; Turner, Dominguez, Maldonado, & Empson, 2013).

Teachers' Cultural Awareness

Teachers need to be aware of cultural differences when planning lessons. For example, when writing a math word problem involving food, choosing something more common to all cultures, like chicken soup rather than hamburgers, may help all students feel welcome and also make the problem easier to understand (Fathman & Crowther, 2006). Teachers in the United States should consider that most of the world uses the metric system. A student from another country may not have an awareness of what an inch or a yard looks like, but they might be quite competent in measurement using the metric system (Zhao & Lapuk, 2019). Furthermore, many countries teach different algorithms for calculations such as long division (Zhao & Lapuk, 2019). This may lead to inaccurate assessment. Teachers should make sure that it is the concept of division the student does not understand, not just the method they are expected to use (Zhao & Lapuk, 2019). A teacher might determine this by asking their students to solve a problem in any way they want, and then reflecting on what strategies they use and

how they solved the problem. Also, teachers may administer a questionnaire (possibly in the students' native language) asking about their math knowledge. Questions might include "How do you use measurement outside of school? What units do you use?" and "What actions do you take when solving an equation?" (Zhao & Lapuk, 2019). Student answers will give teachers insight into their prior knowledge and problem-solving strategies. Finally, teachers should be aware that ELs are a heterogenous category of students. Each student has a unique background and a different level of English proficiency. Taking the time to learn about an EL student's specific background and include their culture in the classroom will lead to decreased anxiety and promote their success (Fathman & Crowther, 2006).

Research has shown that allowing ELs to use their native language in the classroom is more effective than forbidding them from using this asset (Parra et al., 2014). Not only is translating from a native language helpful for ELs to make meaning (Casey et al., 2018; Fathman & Crowther, 2006), assuring ELs that their native language is celebrated and not frowned upon is key to promoting their positive self-image as a learner (Parra et al., 2014). Allowing ELs to use their native language in the classroom allows them to both strengthen their literacy and their self-esteem (Fathman & Crowther, 2006).

Social Positioning

Teachers have the vital power to affect how other students in the class view ELs, as well as how ELs view themselves (Turner et al., 2013). Using various strategies, teachers may position ELs in their classroom as meaningful contributors (Turner et al., 2013). The first of these strategies is statements of validation. When an EL participates in the discussion, using their name and re-stating what they communicated validates their contribution (Turner et al.,

2013). The EL's idea is affirmed by the teacher and the other students observe this interaction. Another strategy is inviting ELs to justify or clarify their thinking (Turner et al., 2013). This positions ELs as competent problem solvers (Turner et al., 2013). In the event that the student's reasoning is flawed, the teacher may position it as a learning opportunity and facilitate a discussion that gets to the correct outcome (Turner et al., 2013). It is important to credit the EL student with initiating the discourse that got the class on the right track, so the class sees them as an important contributor and the EL student feels validated and included (Turner et al., 2013). This is also an opportunity for the teacher to affirm and normalize the use of multiple modalities of communication (Turner et al., 2013). The teacher may encourage the EL to explain their reasoning using a drawing or by acting something out. The third strategy teachers may use to position ELs positively in classroom discussion is inviting other students to respond to an EL's contribution (Turner et al., 2013). When other children build off of an EL's idea, it validates it as worthy of consideration (Turner et al., 2013). By using these strategies in classroom discourse, teachers may position ELs as meaningful contributors with intellectual authority in the classroom (Turner et al., 2013).

Shared Student Experiences

Providing common experiences for students may be a very effective way to encourage learning for ELs (Song et al., 2014; Lee et al. 2019). This gives all students a common context with which to refer or to relate. For example, beginning a science lesson with a related story provides an opportunity for all of the students in the class to relate to the same characters and feel personally connected to the lesson, ensuring the ELs feel included in the class and have the same point of reference as their English-only classmates (Song et al., 2014). Another example

could be a hands-on activity that gives all students a common experience. A makerspace is a functional example of this. Makerspaces are designated areas that contain materials and tools for students to create (Murphy, 2018). They allow ELs to interact with and create with their peers on an equal level (Murphy, 2018). They also have the potential to position ELs as authorities, for example if the EL student shows other students how to make something that they are already skilled at making (Murphy, 2018).

The 5E model is also an example of instruction that provides a shared, hands-on activity that serves as a common experience for a class. A 5E science lesson is inquiry-based and has five parts: engage, explore, explain, elaborate, and evaluate (Burnett, 2018). This model is designed to have students investigate science concepts through hands-on exploration and experimentation. After the students have time to explore, they are asked to construct explanations about a science concept using their own observations and experience (Burnett, 2018). In the "explore" part of the lesson, ELs share a hands-on experience with their peers. ELs are able to participate more actively and fully in the lesson, as these hands-on activities are not dependent on English language proficiency. This model helps ELs link new science concepts with real, concrete, shared experiences of which they are full participants. In contrast, relying on just reading text to introduce a concept makes the material less accessible and therefore separates the EL from the class. A common context such as the hands-on "explore" phase of a 5E science lesson will help ELs feel included. It provides ELs with the same starting point as other students, which creates a safer learning environment and increases motivation (Song et al., 2014). It also provides ELs and English speaking students with a common context in which to communicate (Lee et al., 2019).

ELs often experience negative emotions such as anxiety when faced with a language of instruction they do not speak (Parra et al., 2014). This may lead to dysfunctional social and emotional development (Parra et al., 2014). However, there are several strategies teachers may do to make ELs feel more accepted, respected, and included. By making classrooms more culturally supportive, using language to position ELs as important members of the classroom community, and providing shared contexts for all students to begin learning, teachers may promote ELs positive identity as a STEM learner.

Teachers Learning How to Support English Learners

It is important to provide teachers with training on how to specifically support ELs. Not only do teachers need to have the content knowledge and instructional knowledge required for STEM, they need to have linguistic and cultural awareness to support their English-learning students (Turkan & de Jong, 2018). ELs are a rapidly growing demographic. They make up 9% of all public school students and are found at the majority of public schools (Besterman et al., 2018). However, teachers often do not have vital, research-based training that will allow them to support their EL students to learn and grow.

Furthermore, current preservice training in regard to ELs has also been shown to be inadequate. For example, one study found that the participating math teachers relied on a number of sources, such as anecdotal evidence and personal experience, to make instructional decisions. They did not cite research-based evidence as impacting their decision-making process. Additionally, the teachers spoke only about the content vocabulary as the major language obstacle in the scenarios, which minimizes the importance of all the language

surrounding reasoning and problem solving. Often, the teachers chose to eliminate words and replace them with pictorial or physical representations for only the EL students (Turkan & de Jong, 2018). Based on this evidence, the teachers in this study were shown to view teaching ELs as separate from teaching English-only students. These attitudes and ideas are in conflict with research-based evidence that shows integrating language and literacy with content knowledge leads to positive outcomes (Shaw, Lyon, Stoddart, Mosqueda, & Menon, 2014).

More and more studies are showing that integrating English language development with STEM learning leads to higher EL achievement (Shaw et al., 2014). One program that seeks to train teachers to support ELs based on this research is the Effective Science Teaching for English Language Learners Project, or ESTELL. This project is a collaboration between researchers and educators focused on improving the science learning of K-6 EL students (Staehr Fenner & Snyder, 2017). They have identified several evidence-based teaching practices that most effectively support ELs and lead to higher achievement. These are: collaborative inquiry, science talk, literacy and language use in science, contextualized science activity, and complex thinking and reasoning (Shaw et al., 2014; Stoddart & Mosqueda, 2015). Focusing on these practices, ESTELL aims to give teachers the skills they need to facilitate contextualized, collaborative, and inquiry-based science lessons that also promote language development.

The ESTELL program is structured in a way that gives teachers the opportunity to experience, observe, and reflect on ESTELL science lessons. They are also able to get support and specific feedback from ESTELL coaches (Stoddart & Mosqueda, 2015). Through this process, teachers not only learn the theory behind integrating literacy and science, they get to practice it in a very detailed and personal way. In fact, teachers who have gone through the ESTELL

program feel notably more confident in their ability to teach science integrated with literacy to ELs than their peers who went through a non- ESTELL teacher preparation program (Stoddart & Mosqueda, 2015).

There is evidence that the ESTELL teacher intervention leads to higher science achievement for ELs. In one 2014 study, nine first year teachers received the ESTELL training. Each teacher then taught the same ESTELL science lesson in their classrooms, where a total of 48% of the students were ELs. The study found that after completing the science lesson, EL students made learning gains equivalent to English-only students (Shaw et al., 2014). This is in contrast to national data, which shows that EL's achievement in science is consistently behind that of English-only students (Shaw et al., 2014). Overall, the ESTELL program is a promising method of training teachers to effectively support EL's science and English language achievement.

While ESTELL confronts the issue of training teachers to integrate inquiry-based science and language development, professional development related to ELs should not be limited to this one facet. Collaboration between teachers is also critical for increasing achievement. Professional development should also emphasize the importance of collaborating with others, especially ESOL specialists. Working together on the same shared lesson when each individual teacher has different experiences, strengths, and specialties may provide crucial insight. Also, opportunities to plan and reflect with colleagues before, during, and after a lesson may lead to more positive outcomes for ELs (Peercy, Martin-Beltrán, Silverman, & Nunn, 2015). This shared teacher learning then circulates the school and benefits many more teachers and, by extension, students (Peercy et al., 2015).

As described earlier, a positive attitude with an interest in learning how to connect with ELs is important for teachers to foster an effective learning environment for them. Some teachers may view English monolingualism as the norm, and therefore not put much thought into accounting for linguistic diversity (De Oliveira, 2011). One model for professional development that addresses this issue puts the teachers in EL's position. An instructor taught a math lesson to a group of teachers using exclusively Brazilian Portuguese. After this lesson, the teacher participants reported feeling frustrated (De Oliveira, 2011). One teacher even said, "I felt uncomfortable and like I didn't want to be in the class anymore" (De Oliveira, 2011). Another expressed that trying to follow someone speaking in another language is "more difficult than I thought" (De Oliveira, 2011). The second part of the experience was taught using EL strategies for teaching math. The teachers overwhelmingly found this lesson easier to follow and appreciated the time the instructor took to break down sentences and include visuals (De Oliveira, 2011). Overall, after completing this program, the participants' consensus was that understanding the EL experience is important so that teachers may better understand how to support them (De Oliveira, 2011). Including an experience like this in a professional development program could be eye-opening and beneficial for any teacher who works with ELs, particularly in content areas with a lot of new vocabulary and specific language like science and math.

Conclusion

English Learners are a significant portion of elementary students in the United States (Staehr Fenner & Snyder, 2017). Teachers should be ready to employ strategies to support

them cognitively, in order to promote deeper meaning-making and connection with the STEM content. Also, teachers should know how to support ELs socially and emotionally by being culturally sensitive and positioning ELs as important STEM contributors to the class. Professional development should address teacher attitudes, as well as provide real opportunities for teachers to practice, receive feedback, and reflect on using strategies to support ELs in the classroom.

During my time in the grade 1 SEI classroom, I both observed the classroom teacher use some of these strategies and tried to use them in my own lessons. We both made use of visuals as often as possible. For example, new vocabulary was always introduced with an accompanying illustration or photograph. In one math lesson, the students cut out key words with accompanying pictures and pasted them into sentence frames to compare quantities in a graph. Using this strategy, the ELs were able to demonstrate their ability to interpret the information in a graph and practice the associated math language, without having to produce it themselves. Both the classroom teacher and I also made use of hands-on experiences with real-world objects. The students were given a math worksheet with addition problems using quantities of acorns. The teacher brought real acorns into the classroom to show the students what an acorn is and also to serve as a math manipulatives. In one science lesson, the students were able to explore scales, fur, and feathers on their own and use their observations to explain how each body covering helps animals (i.e. fur keeps animals warm). Every student in the class, regardless of English proficiency, had the opportunity to use the evidence of their own eyes and hands to build understanding of this concept. Finally, the classroom teacher expressed to me the importance of repetition and text re-presentation when teaching ELs. She repeated new

vocabulary numerous times and defined it using multiple modalities, such as English, Cape Verdean Creole, gesture, and picture. She also made use of cognates whenever possible, for example she linked the word “mammal” to the similar-sounding Creole word for feeding a baby with milk. Every student in this SEI classroom was Cape Verdean, as was the teacher. She was able to support the students in their native language, as well as understand their cultural background. I learned a lot from watching her teach and through our conversations about how to best support ELs.

Looking back, the Bridgewater State University “Block” courses should provide teacher candidates an opportunity to do just this. The SEI course is not taken until the semester after teacher candidates first work with students. Many teacher candidates therefore encounter ELs before they have any knowledge on how to best support them. Allowing teacher candidates to specifically practice, get feedback on, and reflect on some of these strategies, similar to the ESTELL model (Shaw et al., 2014), to cognitively and socially and emotionally support ELs would be beneficial for both the teacher candidates and the students they interact with during the Block courses. Personally, I was lucky enough to have the opportunity to teach STEM content to English Learners in several courses, and I found the experience to be challenging, educational, and rewarding. Every student deserves to see themselves as a confident scientist, mathematician, and engineer. As teachers, it is our responsibility to make that a reality for English Learners.

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