Bridging Language and Learning: Empowering Multilingual Learners in STEM

LITERACY IN STEM TOOLKIT

Kristen McInerney, Ed.D.
Nicole Mills, MPP

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Department of Defense DoDSTEM Science · Technology · Engineering · Mathematics

DSEC DEFENSE STEM EDUCATION CONSORTIUM

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Acronyms

AR	Augmented Reality
DMV	DC, Maryland, and Virginia
DoD	Department of Defense
DSEC	Defense STEM Education Consortium
NCES	National Center for Education Statistics
STEM	Science, Technology, Engineering, and Mathematics
VR	Virtual Reality

Introduction

In a rapidly growing global society, careers in science, technology, engineering, and mathematics (STEM) are increasingly vital to the economic and social well-being of all Americans. The need for a diverse, highly skilled STEM workforce will significantly increase within the next decade (Krutsch & Roderick, 2022), at which point it is projected that more than 80% of jobs will require STEM skills. STEM careers are a driving force for innovation, generating creative approaches to solving some of the most complex issues around the globe (Sassler et al., 2017).

With more than 300,000 STEM employees, the Department of Defense (DoD) is the largest employer of federal STEM professionals in the United States. To address the growing demand of STEM professionals entering the workforce, DoD—in collaboration with 26 partners in academia, industry, not-for-profit, and government organizations—developed the Defense STEM Education Consortium (DSEC). DSEC is a collaborative network of STEM-focused organizations who work together to develop and provide programs for K–16 students and teachers with the goal of advancing a skilled, future-ready workforce through broadening STEM literacy and increasing opportunities for learning and leadership in STEM. The consortium is aligned to the Federal STEM Education Strategic Plan, which aims to ensure that "all Americans will have lifelong access to high-quality STEM education and the United States will be the global leaders in STEM literacy, innovation, and employment" (Committee on STEM Education, 2018).

DSEC seeks to achieve these goals through five fundamentals:

- Engage students and educators in meaningful STEM experiences.
- Serve students who are military connected and underrepresented in STEM.
- Connect to the Department of Defense STEM workforce.
- Leverage the network as a force multiplier.
- Evolve the approach based on data.

Not only is STEM literacy foundational in the work supported through DSEC, but it is a predictor of success for students in STEM classrooms across grade levels. Literacy in STEM is not solely based on an individual's ability to comprehend STEM content within a given context—rather, it is a process that requires an individual to use their knowledge to "apply, question, collaborate, appreciate, engage, persist, and understand" how STEM concepts can be used to approach challenges from a personal, societal, or global perspective (Mohr-Schroder et al., 2020).

For multilingual learners (MLLs)—particularly those in a learning environment where the spoken language is not their primary language—the ability to communicate complex STEM content and develop STEM literacy can be hindered by a lack of resources to support those learning efforts. DSEC recognizes this hurdle in accessibility as one that, if not addressed, will create and perpetuate barriers of entry into STEM career fields for many of our country's K–12 students.

Through planned, strategic programming and research-based educator support documents, such as the *Literacy in STEM Toolkit*, DSEC and its partners are working together to ensure these barriers are lifted so that all students—and their teachers—can thrive in effective, rigorous STEM classrooms. Tomorrow's careers require the voices of STEM professionals from all backgrounds, and STEM literacy is one step in ensuring that more of those voices are heard.

Structure of the Toolkit: Multilingual Learner Essential Practices

The *Literacy in STEM Toolkit* is organized into five essential practices. Each essential practice has a short description and provides strategies and resources that educators, camp counselors, and others who support students in STEM can embed within their pre-existing practices in classrooms, outdoor spaces, or wherever learning takes place.

The four domains of language—reading, writing, listening, and speaking—are embedded throughout the five essential practices. MLLs should practice in all four domains daily. These domains represent the fundamental components of language proficiency and play a key role in communication and comprehension of a language. The four domains also play an integral role in STEM education, affecting various aspects of students' engagement, understanding, and communication within this field. Each domain contributes uniquely to the acquisition and application of knowledge in STEM.

By organizing the toolkit into five essential practices, educators can easily find targeted resources and strategies to support students' language development and literacy skills in the context of STEM, with specific considerations for MLLs. The toolkit's organization by essential practices enables teachers to address the specific language needs of their students, including MLLs, and create a supportive learning environment where literacy and STEM skills are interconnected and fostered.

ESSENTIAL PRACTICES

ESSENTIAL PRACTICE 1:
Create a welcoming and warm culture and climate.

ESSENTIAL PRACTICE 2:
Build background knowledge to create a foundation of knowledge and understanding.

ESSENTIAL PRACTICE 3:
Actively and explicitly develop vocabulary familiarity and automaticity.

ESSENTIAL PRACTICE 4:
Provide structured opportunities for speaking and listening practice daily.

ESSENTIAL PRACTICE 5:
Provide multiple opportunities for students to express ideas, thoughts, and information in writing.

Defining Multilingual Learner

When referring to students who are developing proficiency in multiple languages, this toolkit uses the term "multilingual learner" (MLL). This is an expansive term that captures the varied linguistic repertoires, abilities, and experiences of students. Multilingual learners are commonly referred to as "English learners" or "English language learners." This terminology does not holistically describe the many languages a student is developing. MLLs are adding an additional language (English) while still developing, accessing, and enhancing their home languages. Students can be considered MLLs for many years or until their English language proficiency has reached a level where school support is no longer needed. Please note: this toolkit contains resources and references that utilize the term "English learners," and these are applicable to "multilingual learners."

Purpose

The purpose of the *Literacy in STEM Toolkit* is to provide educators with a comprehensive set of resources and tools to support the development of literacy skills in the context of STEM. One key aspect of the toolkit is its focus on supporting MLLs in developing literacy skills in STEM. This toolkit recognizes the crucial role of literacy in STEM education and aims to equip teachers and other educators who support students in STEM with specific strategies and approaches to effectively integrate literacy practices into their STEM experiences.

The toolkit provides specific strategies and resources that support MLLs, such as vocabulary development activities, language supports, and culturally responsive materials. These resources are designed to promote the linguistic and academic growth of MLLs while simultaneously enhancing their understanding and engagement in STEM subjects. The toolkit addresses the need for literacy instruction in STEM by providing teachers with a range of resources and tools tailored to the unique demands of STEM subjects. **It offers a collection of evidence-based strategies, instructional materials, and lesson plans that promote the development of reading, writing, speaking, and listening skills within the context of STEM concepts and content.** By providing these resources, the toolkit empowers teachers to create engaging and meaningful learning experiences that foster both STEM and literacy skills simultaneously.

Our Belief

Integrating literacy practices in STEM education is important in today's increasingly global society, especially for MLLs. As we witness the increasing interconnectedness of disciplines and the growing demand for critical thinking and problem-solving skills, the integration of literacy in STEM subjects becomes essential for students' academic and professional success.

Multilingual learners bring diverse linguistic and cultural backgrounds to the classroom, and acknowledging and valuing their unique perspectives is essential. By tailoring literacy practices to accommodate the needs of MLLs, educators create an inclusive learning environment that fosters both academic achievement and linguistic growth, empowering all students to succeed in STEM disciplines (García & Wei, 2014). By

intentionally considering MLLs in STEM literacy integration, educators create an environment that celebrates diversity, promotes equity, and empowers all students to thrive in their STEM learning journey.

Understanding the WHY: Document Background

INTEGRATING LITERACY PRACTICES IN STEM

Does a chemist or a data scientist have to write reports? Send emails? Speak to others about their work? Of course they do! While STEM fields are often associated with technical expertise, research has shown that literacy skills are vital for success in these disciplines, and the demand for a skilled STEM workforce has emphasized the need to develop students' literacy skills alongside their STEM knowledge and competencies (Boer, 2011). By engaging students in reading, writing, speaking, and listening activities, they actively process information, clarify concepts, and develop a comprehensive understanding of STEM content.

Multilingual learners can meet and exceed grade level standards when provided with language acquisition supports and scaffolds. Incorporating literacy practices in STEM subjects supports language acquisition, vocabulary development, and overall academic achievement for MLLs (de Oliveira & Wilcox, 2017; Lee et al., 2013). **This toolkit provides strategies for educators to embed within their pre-existing practices in classrooms, outdoor spaces, or wherever learning takes place**. By providing targeted support for language development and integrating language and content instruction in STEM, MLLs can enhance their comprehension, participation, and achievement in these areas. STEM subjects often feature complex terminology and specialized vocabulary. By explicitly teaching and reinforcing STEM vocabulary, providing multilingual glossaries, and offering ample opportunities for vocabulary practice and application, educators can support MLLs in understanding and using key terms. Additionally, incorporating bilingual texts, visual aids, and multimedia resources can help scaffold comprehension, providing multiple entry points for understanding complex STEM concepts and bridging the language gap for MLLs.

Integrating literacy practices in STEM education offers several advantages for all students, including MLLs. Firstly, each STEM discipline has its own **unique literacy practices** and modes of communication. Lemke (2011) highlights the significance of discipline-specific literacy practices in STEM, enabling students to engage and communicate within the scientific community. Scientists present their work and their research journey to others using many literacy practices and all four language modalities (reading, writing, listening, and speaking). It is important to note that understanding the distinctive ways of reading and writing in each STEM discipline is essential for students to develop disciplinary expertise and effectively participate in **scientific discourse**, allowing them to navigate scientific texts, interpret data, and articulate their understanding of complex concepts.

STEM education fosters deeper **understanding and knowledge construction**. Shanahan and Shanahan (2008) highlight that literacy in science involves not only reading and comprehending scientific texts but also effectively using scientific vocabulary and understanding the unique discourse of science. They argue that literacy skills are critical for students to access, evaluate, and communicate scientific information. For example, by explicitly teaching and reinforcing STEM vocabulary, building multilingual glossaries, and offering vocabulary practice and application opportunities, educators can support MLLs in understanding and using key terms (Ovando & Combs, 2016). Additionally, incorporating bilingual texts, visual aids, and multimedia

resources can scaffold comprehension, providing multiple entry points for understanding complex STEM concepts (Bunch et al., 2012; García & Wei, 2014).

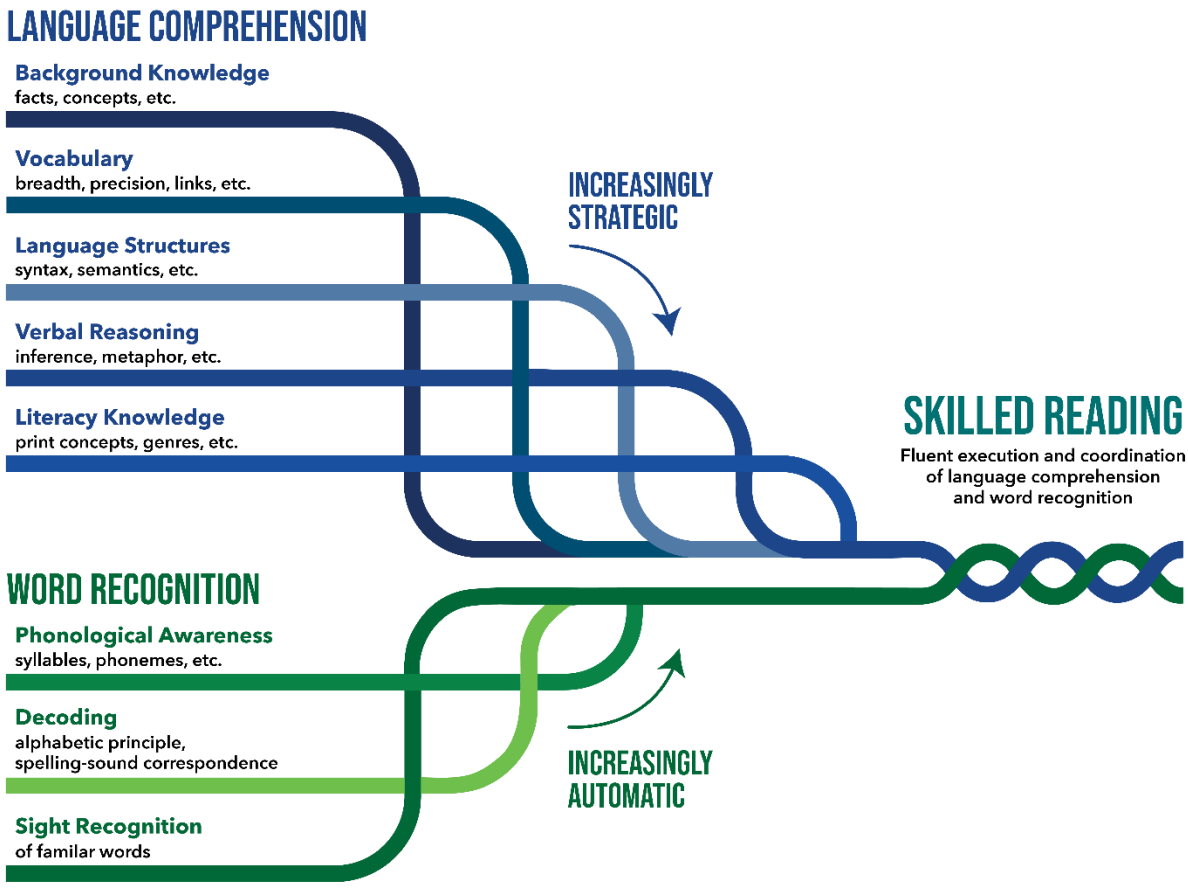
Integrating literacy practices in STEM also enhances **communication skills**. Effective communication is crucial in STEM fields, where professionals need to articulate ideas, present research findings, and collaborate with peers. Bybee (2013) emphasizes the importance of disciplinary literacy in science, enabling students to navigate scientific texts, interpret data, and effectively communicate scientific ideas. By integrating literacy practices in STEM classrooms students have the opportunity to improve their communication skills, enhancing their ability to convey scientific concepts and ideas effectively.

Teachers play a crucial role in supporting students' acquisition of **discipline-specific literacy skills**. By explicitly teaching discipline-specific literacy skills, teachers empower students to engage more effectively with STEM content and communicate their scientific ideas with clarity and precision in English. Lee et al. (2019) emphasize the responsibility of educators to explicitly teach these skills, which helps all students—especially MLLs. They argue that, in order to help students understand and utilize the reading and writing strategies specific to each STEM discipline, teachers need to provide explicit instruction and guidance by modeling effective strategies, offering structured practice opportunities, and providing feedback and support to enhance students' competence in disciplinary literacy. By nurturing these literacy skills, educators can better prepare students to thrive in the increasingly interconnected and information-driven world of STEM (Boer, 2011).

CONNECTION TO SCARBOROUGH'S ROPE

STEM education offers valuable opportunities to support the development of reading skills as defined by Scarborough's "Reading Rope" model (**Figure 1**; Scarborough, 2001). Scarborough's Reading Rope highlights two key components of reading: language comprehension and word recognition. Scarborough found that within these components, several sub-skills contribute to the overall development of proficient reading. STEM activities can effectively target and enhance these sub-skills, promoting reading proficiency in various ways. STEM activities offer opportunities for students to engage with complex texts, build vocabulary, and develop critical thinking skills, which are essential components of language comprehension and word recognition.

Figure 1. Scarborough's Rope



SOURCE: Scarborough, 2001.

STEM activities often require students to **explore real-world problems**, phenomena, and scientific principles. By engaging in hands-on experiments, research, and inquiry-based learning, students develop a deeper understanding of STEM topics. This deepening of background knowledge facilitates language comprehension by providing students with a solid foundation to interpret and comprehend complex texts and concepts. Students **encounter a wide range of texts**, such as scientific articles, research papers, technical manuals, and engineering designs, that require them to apply their language comprehension skills. By analyzing and interpreting scientific texts, students develop their ability to extract meaning, make inferences, and synthesize information, thereby strengthening their language comprehension skills. Engaging in science experiments, engineering projects, and analyzing complex texts involves making connections, inferring meaning, and thinking critically.

STEM activities can also contribute to the development of word recognition skills. Students **encounter technical vocabulary**, scientific terms, and discipline-specific terms related to STEM allowing them to actively engage in decoding and understanding these words in context. STEM activities often involve reading and interpreting charts, graphs, diagrams, and data, which support the development of visual and contextual word recognition skills. This integration of visual information with text enhances students' ability to decode

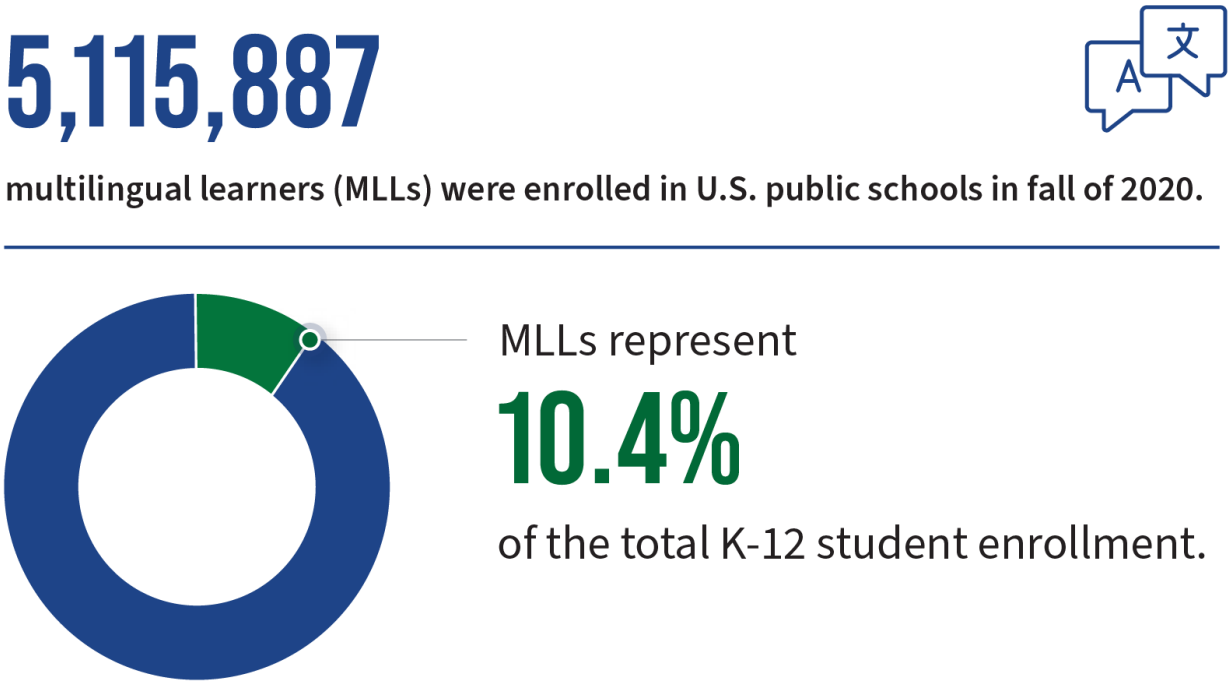
and recognize words accurately and efficiently. Through hands-on experiences, reading relevant texts, and participating in discussions, students acquire and reinforce vocabulary related to STEM concepts. This helps students develop familiarity and automaticity in recognizing and understanding these words, and thereby enhancing their word recognition skills, which are fundamental to reading fluency and comprehension (Ouellette, 2006).

STEM activities provide opportunities for students to engage in **active reading processes** as they locate and evaluate information from various sources using techniques like skimming, scanning, and close reading. STEM activities also involve analyzing and interpreting texts, writing reports, and presenting findings, which promote higher-level reading skills such as summarizing, synthesizing, and critically evaluating texts. These activities, combined with research, documentation, and presentations, allow students to apply their reading and writing skills in authentic contexts, developing overall literacy skills. Integrating language-rich activities and materials in STEM instruction supports language comprehension, word recognition, vocabulary development, critical thinking, and reading in authentic STEM contexts, fostering a strong foundation for success in both literacy and STEM disciplines.

MAPPING MULTILINGUAL LEARNERS

According to data from the National Center for Education Statistics (NCES), in the fall of 2020, approximately 5.1 million MLLs were enrolled in U.S. public schools, which accounted for about 10.4% of the total student enrollment (**Figure 2**; NCES, 2023a). The number of multilingual learners in U.S. schools has been steadily increasing over the years because of factors such as immigration, globalization, and diverse cultural backgrounds.

Figure 2. Multilingual learner statistics, 2020

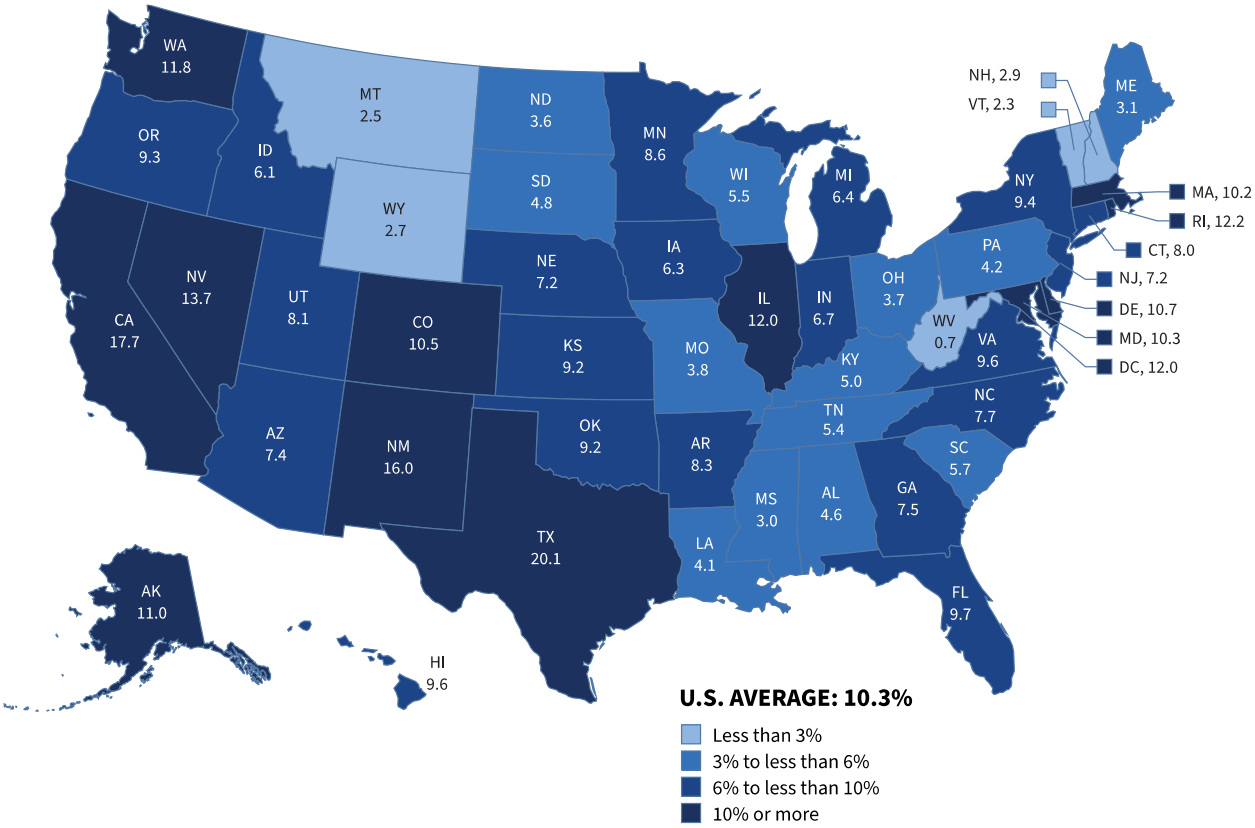


SOURCE: *English Learners: Demographic Trends*, 2023.

Students are identified in this category by their school districts through a home language survey at the time of enrollment to gather information about student background and identify students whose primary or home language is not English. Additionally, schools administer an English language proficiency test in speaking, listening, reading, and writing to determine how to best support MLL students. Federally, students are designated in this category if the individual "(1) was not born in the United States or has a native language other than English; (2) comes from environments where a language other than English is dominant; or (3) is an American Indian or Alaska Native and comes from environments where a language other than English has had a significant impact on the individual's level of English language proficiency" (NCES, 2023b).

The map below (**Figure 3**) visually represents the percentage of MLL students being served in public schools in each state, with all 50 states currently serving MLL students. In 12 of the 50 states, 10% or more public school students are MLLs, with Texas (20.1%) and California (17.7%) having the greatest number of MLL students. The needs of—and, in turn, support for—MLL students are often influenced by the needs of their community and region. While DSEC serves students and educators across the nation, the consortium has four regional hubs located in communities with high concentrations of DoD research institutions. Each hub works to develop STEM ecosystems in their respective region by growing deep partnerships and leveraging efficiencies of scale with multisector partners. This allows them to broaden participation and enrich accessible, inclusive outreach activities. DSEC's hubs are located in San Diego, California; Dayton, Ohio; the District of Columbia, Maryland, and Virginia (DMV) region; and San Antonio, Texas. As shown in **Figure 3** below, three of these hubs are located in states/districts (California, Texas, Maryland, and the District of Columbia) with a higher percentage of students who were MLLs than the national average.

Figure 3. Percentage of public school students who were multilingual learners (MLLs), by state, fall 2020



NOTE: U.S. average is for the 50 states and the District of Columbia. Excludes MLL students who are enrolled in prekindergarten. Categorizations are based on unrounded percentages.

SOURCE: U.S. Department of Education, National Center for Education Statistics, EDFacts file 141, Data Group 678, extracted March 31, 2021; and Common Core of Data (CCD), "Local Education Agency Universe Survey," 2020–21. See Digest of Education Statistics 2022, table 204.20.

Understanding Multilingual Learners

MACRO-DEMOGRAPHICS

MLLs speak many home languages and are adding English as an additional language. English might be a student's third or fourth language. Spanish was the most common home language of MLL public school students in fall 2020 (3.7 million students), representing 75.5% of all MLLs and 7.8% of all public school students. Arabic was the second most commonly reported home language (128,600 students). English was the third most commonly reported home language (124,900 students), which may reflect students who live in multilingual households or students arriving from or adopted from other countries who were raised speaking another language but currently live in households where English is spoken.

For additional information on who multilingual learners are, see the Federal Office of English Language Acquisition's data story: *Our Nation's English Learners* (ed.gov).

CHARACTERISTICS OF MULTILINGUAL LEARNERS

HOME LANGUAGE	NUMBER OF MLL STUDENTS	PERCENTAGE DISTRIBUTION OF MLL STUDENTS[1]	NUMBER OF MLL STUDENTS AS A PERCENT OF TOTAL ENROLLMENT
Spanish, Castilian	3,745,460	75.5%	7.8%
Arabic	128,641	2.6%	0.3%
English[2]	124,917	2.5%	0.3%
Chinese	93,339	1.9%	0.2%
Vietnamese	73,075	1.5%	0.2%
Portuguese	43,426	0.9%	0.1%
Russian	37,159	0.7%	0.1%
Haitian, Haitian Creole	30,063	0.6%	0.1%
Hmong	28,719	0.6%	0.1%
Urdu	25,192	0.5%	0.1%

[1] Detail does not sum to 100% because not all home language categories are shown.

[2] Examples of situations in which English might be reported as an English learner's home language include students who live in multilingual households and students adopted from other countries who were raised speaking another language but currently live in households where English is spoken.

NOTE: Data in this table represent the 50 states and the District of Columbia. Excludes EL students who are enrolled in prekindergarten.

SOURCE: U.S. Department of Education, National Center for Education Statistics, EDFacts file 141, Data Group 678, extracted October 10, 2022; and Common Core of Data (CCD), "State Nonfiscal Survey of Public Elementary and Secondary Education," 2020–21. See Digest of Education Statistics 2022, table 204.27.

For more information, the Department of Education's (ED's) Office of English Language Acquisition (OELA) shares more statistics about the benefits of MLL access to and representation in STEM courses on the *English Learners in Science, Technology, Engineering, and Mathematics (STEM) Fact Sheet* (OELA, 2022).

ACCULTURATION PROCESS FOR MLLS AND FAMILIES

If an MLL is new or relatively new to the United States, the student—and possibly their family—experiences acculturation as a result of being in a new country, new culture, and new community. Acculturation refers to the process by which people who have moved to a new country strive to assimilate their new home's cultural beliefs, behaviors, and values while still retaining their culture of origin (Behara et al., 2018; Schwartz et al., 2013; Whitehead et al., 2020). This is also a two-way process: the culture of the new location adopts elements of the immigrant's culture as well. Acculturation also includes the changes within a group or individual as a result of interactions with individuals of another cultural group (Behara et al., 2018). The dynamics surrounding the acculturative process encompass the experiences of immigrants as they adapt to or cope with the transition of moving from their home country to a new land (Bakhshaie et al., 2018). Families may have moved for economic opportunities, educational or future opportunities, safety and security reasons, family reunification, or political and social stability.

CRITICAL SYSTEMIC FACTORS FOR EMPOWERMENT OF MULTILINGUAL LEARNERS

Support and empowerment of MLLs requires a comprehensive approach that considers various systematic factors. **Figure 4** shows some of the critical systematic factors for educators to consider that enable the support and empowerment of MLLs.

Figure 4. Systematic factors to support and empower MLLs

CURRICULUM & INSTRUCTIONAL PRACTICES

Incorporate materials, teaching strategies, and assessment methods that consider the diverse linguistic and cultural backgrounds of MLLs. It also involves providing appropriate language support to help MLLs access the curriculum.

PROFESSIONAL DEVELOPMENT FOR TEACHERS

Providing professional development opportunity for teachers, such as training on culturally relevant pedagogy, language acquisition theories, and differentiated instruction, can enable teachers to better support MLLs in their classrooms.

COLLABORATION AND COMMUNICATION

Collaboration and communication among teachers, administrators, families, and community members can help create a supportive, welcoming, and inclusive environment for MLLs. It also enables the busting of myths, and sharing of resources, best practices, and information about the specific supports for MLLs.

FAMILY & COMMUNITY ENGAGEMENT

Schools should take the first step to build strong partnerships with families, providing them with information, resources, and opportunities to actively participate in their child's education and decision-making processes to create a welcoming and inclusive school environment.

ASSESSMENT & EVALUATION

Fair, valid assessment and evaluation methods that consider the linguistic and cultural diversity of MLLs should measure both academic progress and language growth, which provides a comprehensive understanding of the strengths and assets of MLLs. The results can then inform targeted interventions and support.

ACCESS TO RESOURCES

Ensuring equitable access to resources, such as books, technology, internet, and educational materials, is vital for the support and empowerment of MLLs. For families, ensure steps to access resources are translated into families' preferred languages.

LANGUAGE DEVELOPMENT PROGRAMS

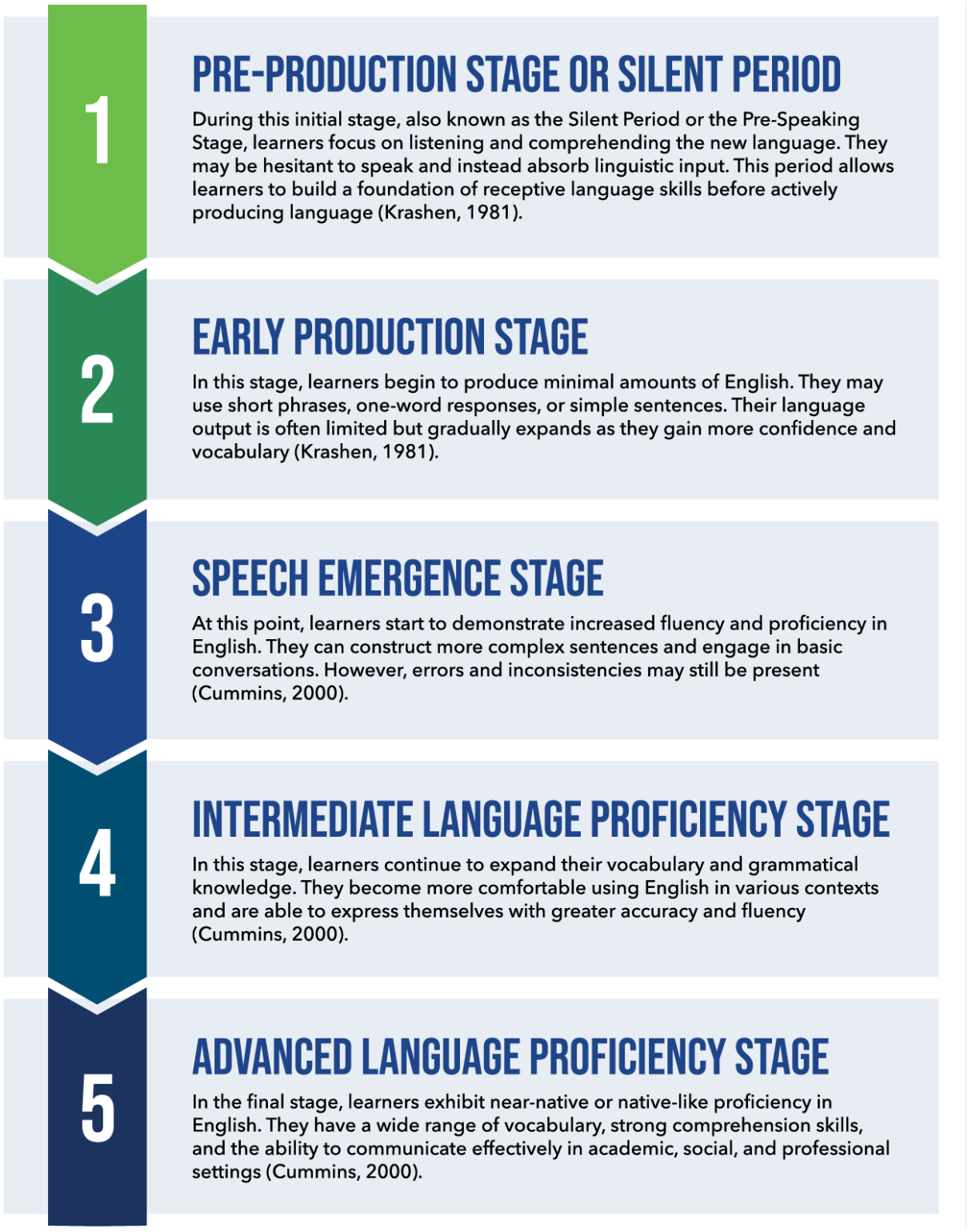
Offering targeted language development programs including English support and sheltered classes, bilingual education, or transitional bilingual programs, depending on the specific needs of the students and the available resources.

By addressing these critical systematic factors, educational systems can create an inclusive and supportive environment, leading to MLL academic success and overall well-being. This toolkit provides strategies and resources for the factors listed.

LANGUAGE ACQUISITION PROCESS FOR MULTILINGUAL LEARNERS

As educators, it's important to be aware of the stages and process of English language acquisition—which includes a Silent Period—for students learning another language. Researchers identified this process for second language acquisition that may take 5 to 7 years (Cummins, 2000; Krashen, 1981). **Figure 5** provides an overview of the steps in the second language acquisition process.

Figure 5. Stages of second language acquisition



It is important to note that language acquisition is a dynamic process, and the time required to progress through these stages can vary significantly for each individual learner. Additionally, there may be differences

between receptive and expressive language development. **Receptive** language refers to the ability to understand and comprehend spoken or written language (listening and reading skills), while **expressive** language involves the production and expression of language (speaking and writing skills).

During the Silent Period and the early stages of language acquisition, learners may demonstrate stronger receptive language skills than expressive language skills. They may understand more than they can actively communicate (Genesee et al., 2006). This discrepancy is a normal part of the language development process, and learners gradually bridge the differences between their receptive and expressive language abilities as they gain proficiency and confidence.

Understanding the HOW: Building Literacy with Multilingual Learners in STEM

ESSENTIAL PRACTICE 1:
CREATE A WELCOMING AND WARM CULTURE AND CLIMATE

DESCRIPTION

First impressions count! Creating a welcoming and supportive environment for students and families adds to a sense of belonging (McInerney, 2022). Educators have an opportunity to make those first impressions, days, weeks, and months a warm and inviting experience. Building a positive classroom culture and climate is essential for creating an inclusive and supportive learning environment where all students, especially MLLs, feel safe to take risks in their learning journey. In STEM, it is important to create a non-judgmental classroom culture that values effort and perseverance, and that encourages students to view mistakes as valuable learning experiences that contribute to their growth and development as STEM learners. A positive classroom culture promotes a sense of belonging, collaboration, and engagement, which are essential for the academic and social development of students (National Research Council, 2011).

STRATEGIES & RESOURCES

PRACTICE	WHAT DOES THIS LOOK LIKE?	RESOURCES
Build a Supportive Community	Create a sense of belonging and community within the **classroom**. Promote a classroom environment where students support and encourage each other's growth and success. • Morning Meetings: Begin each day with a morning meeting where students gather in a circle to greet each other, share experiences, and express appreciation for one another. • Community-Building Games: Incorporate community-building games or activities into the classroom routine so that students get to know each other better. These can include team-building exercises, problem-solving challenges, or group discussions that encourage students to work together and build relationships.	The Four Components of Morning Meeting: Learn about the four components of Morning Meeting to build a strong sense of community and set children up for success socially and academically. 21 Team-Building Activities for Students: Explore new ways to add some fun and levity to help students build informal connections with peers.

	• Community Circles: As a part of Restorative Practices, Community Circles gather students in a circle to discuss a class topic, which can range from favorite snacks to reflections on the unit's learnings. These topics ensure that all voices can share their perspective with no right or wrong answers, only building community. • Heterogeneous Grouping: Identify each student's level of English language proficiency: high, medium-high, medium-low, or low. Seat students in heterogeneous groups of four: within each group, seat a high language proficiency student beside a medium-low language proficiency student, and a medium-high beside a low. This seating strategy helps to build confidence and self-efficacy with English. Students should not be told their proficiency level; rather, the teacher should model collaborative expectations for behaviors. Example: A teacher might say, "If your partner is unclear about the directions, clarify in any language that they would like." • Group Roles: Assign specific roles when working in groups, such as facilitator, timekeeper, note-taker, and speaker. This ensures active participation and engagement from all students.	Story Cubes: Throw the dice and create a story using the nine symbols on the faces of the dice. Building Community With Restorative Circles: A technique for proactively building the skills and relationships students will need when challenges arise. Video - 60-Second Strategy - Community Circles: Ensure that all students feel seen and heard by facilitating an opening and closing exercise where every student contributes. How should ELLs be grouped for instruction? There are three ways you can group your MLLs, depending on your learning environment. Video - English Learners in STEM Subjects: Learn about the importance of MLLs in STEM subjects. Video - Creating Class Norms: Management in the Active Classroom: Watch to see how to facilitate student-created norms.

Embrace Mistakes	Foster a growth mindset by emphasizing the value of effort, perseverance, and learning from mistakes. Create a safe space where mistakes are seen as part of the process of learning something new, especially a new language. Respond to mistakes with empathy and guide students in reflecting on what they have learned. • Reflective Journals: Have students keep a reflective journal where they document their mistakes, challenges, and lessons learned throughout their STEM learning journey. Students can also reflect on their language growth journey. • Mistake Show-and-Tell: Allocate regular class time for students to present and discuss mistakes they made during activities, experiments, or working with others. Encourage them to explain the process/problem, what went wrong, and what they learned from the experience. • Design Challenges: Engage students in design challenges or open-ended projects where making mistakes is an inherent part of the learning process. Encourage experimentation, iteration, and problem-solving. Emphasize that mistakes are valuable opportunities for learning and improvement. Encourage students to ensure that all group members have a role. • Mistake Analysis: Allocate time for students to analyze and discuss common mistakes made in STEM concepts or procedures. Provide them with sample mistakes and ask them to identify the errors, explain why they occurred, and propose strategies for improvement. • Growth Mindset Discussions: Discuss famous scientists or inventors who faced setbacks and failures before achieving success. Explore the	A Collaborative Approach to Mistake Analysis With Older Students: For secondary students, this mistake analysis process helps identify common errors. These are science's Top 10 erroneous results: Even career scientists make mistakes and learn from them. Reflective Journals and Learning Logs: Several protocols for structuring reflection for students, especially about their thinking, any mistakes they made along the way, and what they learned from them. Even Geniuses Work Hard: Dweck's research on the importance of a growth mindset.

	idea that mistakes are stepping stones to progress and breakthroughs. • Emphasize the Power of "Yet": Teach students to add the word "yet" to their statements to signify that they may not have achieved something *yet*, but with time and effort, they can. For example, instead of saying "I can't solve this problem," encourage them to say "I can't solve this problem *yet*, but I will keep trying."	
Eliminate the Notion of "Broken English"	Celebrate the diversity of languages and accents as assets that contribute to a rich learning environment. Accents are beautiful, and they mean someone speaks more than one language. Empower students to communicate and express themselves without judgment or criticism. Acknowledge that different languages offer unique perspectives and ways of understanding scientific concepts. • Classroom Language Policy: Collaboratively establish a classroom language policy that emphasizes the acceptance and appreciation of all languages spoken by students. Display the policy visibly in the classroom and consistently reinforce it throughout the school year. • Cognates: Use cognates or words that share similar meanings and spellings across different languages when introducing new concepts or vocabulary. • Language Show and Tell: Encourage students to share their linguistic backgrounds and experiences by showcasing their home languages, dialects, or cultural practices. • Language Buddy System: Establish a language buddy system where students with different language backgrounds support each other in language learning. This fosters a sense of	How to Create a Welcoming Classroom Environment for ELLs: Several strategies to welcome MLLs into your space so they feel safe to try and take risks. Everyone Has an Accent | Learning for Justice: Information about dialects and the beauty of accents, which are not at odds with acquiring English. Teachers as Language Policy Planners: This article highlights how a science teacher embeds English and science objectives into lessons. Starting a Heritage Language Book Club: Foster pride in students' home languages by starting a multilingual book club.

	camaraderie and helps eliminate the idea of "broken English" by promoting language learning as a collaborative process. • Multilingual Book Club: Set up a multilingual book club where students can read books in their native languages or explore literature from different cultures. Encourage discussions and reflections on the linguistic richness found in these texts. • Language Role Models: Invite STEM industry guest speakers who are bilingual or multilingual to share their experiences and demonstrate the advantages of being able to speak multiple languages.	
Celebrate Effort and Success	Recognize and celebrate students' efforts, achievements, and growth, especially with a new language. Acknowledge students' progress, both individually and as a class, and highlight examples of perseverance, problem-solving, and risk-taking. Use positive reinforcement strategies such as verbal praise, certificates, or classroom displays to highlight students' successes and efforts. Imagine completing a project-based learning unit in your third language—incredible! Remember that every student is unique, so it's essential to tailor these strategies to match their preferences and styles. • Personalized Feedback: Provide specific and constructive feedback to students on their work, highlighting their strengths and areas for improvement. Acknowledge the effort they put into their assignments and projects. • Public Acknowledgment: Take time during class to publicly recognize and celebrate students' accomplishments. Share success stories and examples of growth with the whole class,	Using Videos to Give High School Students Personalized Feedback: Explore how feedback, even via video, can help build student–adult relationships. Making Sure Your Praise Is Effective: Survey your students to see how they like to receive praise. Sometimes it's a call home, a public announcement, a certificate, or a personalized note. Goal Tracker: Student Goal Trackers are a great way to build autonomy and self-efficacy—and then celebrate growth, especially language growth!

	making sure to respect students' privacy and consent. • Positive Notes/Home Messages: Send positive notes or messages to students' parents or guardians to inform them about their child's progress and achievements. This reinforces the celebration at home and encourages continued effort. • Goal Setting and Tracking: Help students set realistic goals for themselves and track their progress over time. Celebrate reaching these milestones and encourage them to set new challenges. • Peer Recognition: Encourage students to recognize and celebrate each other's efforts and achievements. Implement a peer recognition system where students can nominate their classmates for their accomplishments.	5 Research-Based Tips for Providing Students with Meaningful Feedback: Learn five best practices for giving students feedback. Feedback That Fosters Growth: Learn how to give feedback that produces learning growth by making sure it's meaningful and directed at the skill rather than the student.
Cultivate a Positive Teacher–Student–Family Relationship	Develop a positive rapport with your students and their families. Show genuine interest in their well-being and success. Get to know their strengths, interests, and challenges. Call families to ask about their hopes, dreams, and important things to know about their child. Foster a sense of trust by being approachable, respectful, and responsive to student and family needs. • Culturally Responsive Instruction: Get to know your students well. Embrace culturally responsive teaching practices by valuing and incorporating the diverse cultural and linguistic backgrounds of MLLs. By honoring their experiences, knowledge, and contributions, educators create a supportive and inclusive learning environment that fosters engagement and a positive sense of identity.	4 Ways to Build Relationships With Students Whose Backgrounds Differ From Yours: Learn ways to promote strong relationships with students. Engaging Migrant Families: Find many helpful resources to reflect, connect, collaborate, and encourage families to lead in your school or learning space. Partnering with Immigrant Families to Promote Student Success: This report showcases best practices for engaging with immigrant families.

	• Share Personal Stories: Occasionally share personal stories or experiences that relate to the content being taught or the challenges students may be facing. This personal connection can help students see you as a relatable figure and strengthen the teacher–student relationship. • One-on-One Conferences: Schedule individual conferences with each student to discuss their progress, goals, and concerns. Use this dedicated time to provide personalized feedback, offer support, and build a connection with each student. • Family Phone Calls: Access an interpreter if needed and make regular contact with students' families to celebrate and discuss progress. Check on family members' well-being too. WhatsApp and Zoom can provide a free way to contact family members in other countries as well. Family is family no matter where they are.	The Power of the Positive Phone Call Home: This article describes the power of positive phone calls home. Empower Students Through Individual Conferences: Explore some of the benefits of one-on-one conferences.
Provide Opportunities for Student Voice and Choice	Empower students by providing opportunities for them to have a voice and make choices in their learning. Incorporate student-centered activities, projects, and assignments that allow for creativity, self-expression, and autonomy. Give students opportunities to share their ideas, make decisions, and take ownership of their learning. • Choice Boards or Flexible Assignments: Offer a variety of assignment options that align with learning objectives. Allow students to choose the format, such as written essays, presentations, videos, or creative projects, based on their interests and strengths. • Incorporate Student Interests: Integrate students' interests and hobbies into the learning process or topic selection, making	Using Choice Boards to Boost Student Engagement: Choice boards can include options to complete tasks/activities in home languages too. 5 Ways to Give Your Students More Voice and Choice: Add elements of autonomy into your plans. Connect Students' Background Knowledge to Content in the ELL Classroom: Learn about students' interests and background knowledge and link them to new topics.

	connections between the curriculum and their real-life experiences. • Personal Learning Projects: Set aside time for personal learning projects where students can pursue topics or skills outside the regular curriculum, fostering their curiosity and passion for learning.	

ESSENTIAL PRACTICE 2:
BUILD BACKGROUND KNOWLEDGE TO CREATE A FOUNDATION OF KNOWLEDGE AND UNDERSTANDING

DESCRIPTION

Building background knowledge involves acquiring and developing a foundation of knowledge and understanding in a specific subject or topic. When students build background knowledge, they are acquiring a broad range of knowledge and experiences that serve as a foundation for future learning and understanding. To build background knowledge, provide students with the opportunity to first experience a phenomenon or problem before adding language, vocabulary, and conceptual understanding. This background knowledge provides a framework for making connections, being exposed to new academic vocabulary, interpreting new information, and engaging in deeper levels of thinking and comprehension.

Building background knowledge is especially important for MLLs as it provides a strong foundation for their language development and overall academic success. By actively acquiring and expanding their knowledge base, MLLs are exposed to a wider range of vocabulary, concepts, and cultural references. This exposure not only enhances their understanding of the subject matter but also supports their language proficiency and fluency. Building background knowledge helps MLLs make connections between their native language and the language of instruction, facilitating the transfer of knowledge and the development of academic language skills. It also promotes critical thinking and problem-solving abilities, as MLLs can draw upon their diverse linguistic and cultural experiences to approach new challenges and tasks.

STRATEGIES & RESOURCES

PRACTICE	WHAT DOES THIS LOOK LIKE?	RESOURCES
Authentic Texts and Real-World Applications	Connect the readings to real-world applications and encourage students to explore how scientific knowledge is used to address global challenges. • Culturally Relevant Content: Integrate culturally relevant content and examples that resonate with MLLs' backgrounds and experiences. This inclusion fosters a sense of connection, relevance, and engagement with STEM topics and facilitates the transfer of prior knowledge and cultural assets to new learning situations. • Authentic Texts: Incorporate authentic texts, such as scientific articles, research papers, case studies, or real-world examples, to expose students to the types of texts they will encounter in STEM fields. • Phenomenon Based Learning: Phenomena are observable events that occur in the universe and that we can use our science knowledge to explain or predict. Use phenomena to engage students in practices to develop the knowledge necessary to explain or predict the phenomena. • Project-Based Learning (PBL): A teaching approach in which students learn by actively engaging in projects set around a real-world challenge or problem.	Phenomenon Based Learning: Students connect what they are learning to what goes on in the real world. Inquiry Lesson Plan Template: Use this template to pair hands-on investigations of scientific phenomena with secondhand investigations using texts to help students answer the same fundamental inquiries. Integrating Language While Teaching STEM (ed.gov): Effective instructional practices, examples, and practice shifts for science and engineering educators. What is PBL? Explore short videos that show PBL in action, capturing the nuts and bolts of a PBL unit from beginning to end.

Pre-Activity Engagement	Activate students' prior knowledge of a topic so that they can consciously use it as they engage in the activity. For example, before reading a text with a jungle as the setting, ask students what they already know about jungles and discuss. • Anticipation Guides: An anticipation guide is a set of questions used to activate students' prior knowledge and engage them in the topic of a lesson or reading before they delve into it. The purpose of an anticipation guide is to help students make predictions, connect to their existing understanding, and pique their curiosity about the subject matter. • KWL Charts: The KWL chart allows students to share what they know and want to learn about a topic and helps the teacher identify students' existing background knowledge. Once students have gained additional knowledge about the topic, they can return to the chart to summarize what they learned. • Pre-teach Vocabulary: Pre-select words from the text that could hinder comprehension, explain the meanings with student-friendly definitions, provide examples of how the words are used, ask students to repeat the words three times, and engage students in activities to practice with the word. • Pose Engaging Questions: Pose thought-provoking questions related to the activity's topic to pique students' curiosity and get them thinking. • Use Multimedia: Share a short video, image, or anecdote related to the topic	Background Knowledge and ELLs: What Teachers Need to Know - A step-by-step process: Learn about the importance of background knowledge for MLLs, as well as strategies for accessing and building students' background knowledge as part of lessons. The Power of Text Sets: This article explains text sets and provides guidance on how to implement this research-based strategy. 6 Scaffolding Strategies to Use With Your Students: Explore how to break learning up into chunks and provide a concrete structure for all learners. Anticipation Guide: Learn how to use an anticipation guide and see a quick video clip of one in action.

	to capture students' attention and spark interest. • Text Sets: Provide scaffolded reading materials that gradually increase in complexity. Start with simpler texts that offer basic explanations and visual cues, and then gradually introduce more challenging readings. This approach supports MLLs in building their background knowledge at a pace aligned with their language proficiency.	
Multiple Means of Representation	Use a mix of audiovisual resources, readings, and multimedia to expose students to diverse language styles and accents, enhancing their ability to understand and adapt to different communication situations. • Visual Support: Incorporate visuals to complement written text. Visual representations can provide additional context and support comprehension, especially for MLLs who may be developing proficiency in the language of instruction. • Realia Wall: An interactive word wall that combines real objects, models, pictures, photos, and labels as a resource for students to help with vocabulary concepts. It helps students build background knowledge and connect their learning to what they already know. • Graphic Organizers: Graphic organizers such as story maps, T-charts, and Venn diagrams assist in identifying and connecting key ideas, relationships, and vocabulary, helping students visually represent and organize their understanding of STEM concepts.	Video - Using "realia" to build background: Watch Albuquerque teacher Ali Nava describe the "realia" activity she used to introduce *Burro's Tortillas* and some of the items she brought into the classroom for the lesson. Video - GLAD Pictorial Input Chart: Watch this video to see a visual notetaking aid to support listening. Maslyk's *Remaking Literacy* (2020): Explore how to transform literacy teaching and learning by integrating maker projects for elementary learners. Google Images: Don't be afraid to simply search Google Images to find visual representations. Using Multimedia to Promote Vocabulary Learning: Supporting English Language Learners in Inclusive Classrooms: See an example of how to implement multimedia during read-alouds.

	• Diagrams, Charts, and Infographics: Use diagrams and charts to help students visualize the appearance, structure, or workings of something or to share information quickly and clearly. • Multimedia Resources: Incorporate multimedia resources such as videos, documentaries, and interactive simulations. These resources can provide visual and auditory representations of STEM concepts, expose students to real-life applications, and introduce specialized vocabulary.	Using Graphic Organizers with ELLs: Explore ideas for graphic organizers. Video - English Learners in STEM: Interactive Graphic Organizer and Mix & Match: See how one teacher uses these strategies to support students in classifying and describing characteristics of a riverbank ecosystem. Story Maps: Learn how to use story maps and explore lesson plans and templates. Concept Maps: Learn how to use concept maps and explore concept map lesson plans and templates. Video - Comparing two texts with Venn diagrams: In this clip, Albuquerque teacher Ali Nava leads her students through a comparison of *Burro's Tortillas* and *The Little Red Hen*. T-Charts: Learn ways to use T-Charts to make comparisons.
Formative Comprehension Checks	Incorporate regular comprehension checks during or after listening activities. Ask questions that require students to recall specific details, identify main ideas, or make inferences. Use a combination of visual and verbal cues to assess students' understanding. • Thumbs Up, Thumbs Down: Ask students a question, give appropriate think time, and ask them to show thumbs up for clear understanding, thumbs to the side	Video - Quick ways to check understanding: Watch as a teacher describes some of the ways she informally checks understanding, such as "thumbs up, thumbs down" or "fist of five." 20 Creative Ways to Check for Understanding: Explore 20 fun and simple ways to see who's good to go, who's almost there, and who needs some one-on-one.

	for "so-so" understanding, or thumbs down if they are confused or uncertain. • Fist of Five: Students use their hand to rate their level of understanding. • Color Wheel: Show students a variety of colors or shades of a color to determine how they're feeling about a topic. Provide a one-word adjective for each color. • Emojis: Students use emojis to assess their level of understanding of a concept.	8 Quick Checks for Understanding: Learn eight practical and proven formative assessment techniques to use as a quick "pulse check" to gauge students' understanding. Video - Inviting Participation with Thumbs-Up Responses: Learn about a quick assessment strategy that replaces raised hands, encouraging more students to contribute by accommodating their different processing needs.
Field Trips and Guest Speakers	Organize field trips to STEM-related locations such as science museums, research institutions, or local industries. Alternatively, invite guest speakers from STEM fields to share their experiences and expertise. These opportunities expose students to authentic STEM environments, terminology, and professionals, expanding their background knowledge and vocabulary. • Interactive Workshops: Collaborate with the guest speaker to design hands-on workshops or activities that allow students to directly engage with the subject matter. • Live Demonstrations: Arrange for dynamic demonstrations that showcase concepts in action. For instance, a chemistry expert could perform exciting experiments. • Mentorship Sessions: Allow students to have one-on-one or small group mentorship sessions with the guest speaker to ask questions and seek guidance.	Carnegie Science Center - Virtual Field Trips and STEM Programs: Find engaging virtual STEM programs that align with your curriculum and get students excited about science. Discovery Education - Virtual Field Trips: These no-cost virtual field trips come with a companion guide with standards-aligned hands-on learning activities. The Nature Conservancy - Explore the World with Virtual Field Trips: Designed for ages 9–15 but customizable for all ages, these virtual field trips allow students to travel the world and explore natural environments without leaving the classroom. Each virtual field trip contains a video, teacher guide, and student activities.

	• Virtual Tours: Organize virtual tours of museums, laboratories, factories, or historical sites. Use 360-degree cameras to provide an immersive experience. • Digital Reality: Utilize augmented reality (AR) or virtual reality (VR) platforms to simulate field trip environments and interactions with guest speakers. • Virtual Panel Discussions: Organize panel discussions featuring guest speakers and experts from different fields, allowing students to gain insights from diverse perspectives. • Global Connections: Invite guest speakers from different parts of the world to provide a global perspective and expose students to diverse cultural contexts.	
Hands-on Experiments and Activities	Engage students in hands-on experiments, simulations, or problem-solving activities that provide direct experiences with STEM concepts. Encourage students to record their observations, document their procedures, and analyze their results. These hands-on activities deepen their understanding and provide a practical foundation for building background knowledge. • Guided Exploration: Provide materials and instructions for the experiment or activity but allow room for exploration and experimentation within those parameters. • Nature Walk and Observation: Take students on a nature walk to observe and document different types of plants, animals, and ecosystems.	NOAA - Hands-on Science Activities: Explore hands-on activities that can be done in 15–30 minutes and get students thinking about how things really work. Let's Talk Science – Classroom Resources: Bring critical thinking and curiosity to life with this library of curriculum-aligned, bilingual, and ready-to-use resources.

ESSENTIAL PRACTICE 3:
ACTIVELY AND EXPLICITLY DEVELOP VOCABULARY FAMILIARITY AND AUTOMATICITY

DESCRIPTION

Vocabulary development is crucial in STEM, particularly for MLLs. STEM subjects encompass a vast array of specialized terminology and technical vocabulary that is essential for understanding and effectively communicating scientific concepts. A robust STEM vocabulary enables students to accurately describe phenomena, analyze data, and articulate their thoughts and findings. It also facilitates collaboration and effective communication with peers and professionals in STEM fields. By actively developing their STEM vocabulary, students enhance their ability to think critically, problem-solve, and engage in scientific inquiry.

STRATEGIES & RESOURCES

PRACTICE	WHAT DOES THIS LOOK LIKE?	RESOURCES
Explicit Vocabulary Instruction	Provide direct and explicit instruction of STEM vocabulary, focusing on key terms and concepts relevant to the specific topic or unit of study. Break down complex terms into smaller components, provide definitions, offer visual representations, and encourage students to use the terms in context. Gradually release responsibility, allowing students to independently apply and reinforce the vocabulary in various STEM activities.	*Bringing Words to Life* (Beck et al., 2013): Learn how to select words for instruction, introduce their meanings, and create engaging learning activities that promote both word knowledge and reading comprehension. Vocabulary Instruction - Strategies for the Classroom: Explore strategies for teaching vocabulary. 4 Ways to Teach Vocabulary and Reading Comprehension: Learn how to engage students in active processing to improve both vocabulary and reading comprehension.

		Classroom Strategies - Vocabulary Development: Learn how vocabulary relates to MLLs and explore strategies to support vocabulary development. WWC - Teaching Academic Content and Literacy to English Learners in Elementary and Middle School (ed.gov): This practice guide provides four recommendations that address what works for English learners during reading and content area instruction. How to Quickly Introduce New Topics or Vocabulary: Explore strategies for introducing new topics or vocabulary.
Contextualized Vocabulary Practice	Embed vocabulary practice within meaningful and authentic STEM contexts. Encourage students to use new vocabulary in discussions, presentations, or written assignments related to STEM topics. Connecting vocabulary to real-world applications helps students develop a deeper understanding and long-term retention of the terms. • Real-World Scenarios: Present STEM-related scenarios or problems that require learners to use the target vocabulary words to analyze, solve, or explain. This connects vocabulary to practical applications. • Sentence Frames and Sentence Starters: Provide sentence frames or sentence starters that scaffold MLLs' use of STEM vocabulary in oral and written communication. These linguistic supports assist MLLs in constructing sentences and	Accountable Talk Features and Language Stems: A resource to provide linguistic scaffolds for collaborative discourse. Use sentence frames to build academic language: Explore ways to support students' vocabulary development through the use of sentence frames.

	expressing their ideas using appropriate STEM terminology. • Lab Reports and Scientific Writing: Have learners write lab reports, research summaries, or scientific articles that incorporate the target vocabulary words. This reinforces vocabulary usage in professional contexts.	
Multilingual Glossaries	Develop bilingual glossaries that provide translations of STEM vocabulary in students' native language alongside the language of instruction. This resource supports MLLs in understanding and making connections between STEM terms in their native language and the language of instruction. • Visual Bilingual Dictionaries: Provide bilingual dictionaries with visuals where learners can see the word, its translation, and an accompanying image. This aids comprehension across languages. • Learner Dictionaries: Use a learner dictionary designed specifically for students learning English as a second language. This type of dictionary presents definitions in a more accessible language for MLLs. • Vocabulary Journals: Vocabulary journals are tools used in language learning to help learners actively engage with new words, their meanings, and their usage. These journals provide a structured way for individuals to record, review, and reflect on the vocabulary they encounter or are explicitly taught. • Vocabulary Charts: Use charts or tables to list new words along with their definitions, example sentences, and related images.	Bilingual Glossaries and Cognates: Explore various glossaries to support MLLs' vocabulary development. 7 Activities When Creating Your Child's Vocabulary Journal: Explore seven ways learners can interact with the word in their journal. Vocabulary Journal Template: This template can be used to create student vocabulary journals for any subject area.

	This provides a comprehensive overview of the word's meaning and usage.	
Visual Supports and Labels	Use visual supports such as labeled diagrams, illustrations, or real-life images to reinforce the meaning of STEM vocabulary. Incorporate visual labels for objects, equipment, or materials used in hands-on activities, allowing MLLs to associate the terms with visual representations. • Realia Wall: An interactive word wall that combines real objects, models, pictures, photos, and labels as a resource for students to help with vocabulary concepts. It helps students build background knowledge and connect their learning to what they already know. • Real-Life Photographs: Use real photographs to illustrate the meanings of words. This approach connects vocabulary to the students' everyday experiences. • Cognates and Visuals: Identify cognates (words that share similarities across languages) and pair them with corresponding images. This helps multilingual learners recognize familiar words and understand their meanings in context. • Gesture and Action Visuals: Incorporate gestures or actions that are associated with certain words to help students remember them. For instance, mimic the action of running while teaching the word "dash." • Multilingual Labels: Label classroom objects, furniture, and learning materials with both the target vocabulary word and its translation in the learners' native	Video - Realia Walls & Sentence Frames: Watch how a first-grade teacher uses a realia wall and sentence frames to explore weather-related items. Visual Supports for Learning: Explore examples and specific routines to support learning. Using Multimedia to Promote Vocabulary Learning: Look at an example of how to implement multimedia during read-alouds. Classroom Visuals and Supports: A collection of high-quality visuals and supports that can be printed and used immediately to support young children's development and learning. 10 Ways to Use Technology to Build Vocabulary: This article presents 10 strategies that use free digital tools and internet resources to engage students in vocabulary learning.

	languages. This creates a visual association between the word and its meaning. • Multimedia Resources: Use videos, animations, and multimedia materials that showcase visuals along with spoken words. This approach engages multiple senses and helps reinforce vocabulary acquisition.	
Word Mapping	Use word mapping techniques to encourage students to make connections between new words and their existing knowledge, including synonyms, antonyms, examples, and non-examples. • Semantic Webs: Use a semantic web to visually display the connections between a word or phrase and a set of related words or concepts. • Concept Mapping: Use a concept map to help students develop their understanding of a new concept by thinking about the concept in several ways. • Frayer Model: Use the Frayer model to help students develop a comprehensive understanding of new vocabulary by identifying the word, definition, characteristics, examples, and non-examples. • Association and Visualization: Encourage students to associate new words with familiar words, images, or personal experiences to enhance memory retention.	Connecting Word Meanings Through Semantic Mapping: Explore how semantic mapping can be used to help students identify, understand, and recall the meaning of words they read in the text. Word Maps: Learn how to use word maps, and explore lesson plans and templates. Frayer Model: Learn step-by-step instructions for using the Frayer model to support vocabulary development. Includes a template. Core Vocabulary Word Maps: Explore examples of word maps that can be used to support vocabulary development. Lesson Plan - Internalization of Vocabulary Through the Use of a Word Map: Look at an example lesson that provides students with a concrete way to learn vocabulary.

Multiple Exposures and Repetition	Provide multiple exposures to STEM vocabulary through reading, listening, and speaking activities. Engage students in repeated practice and reinforcement of new terms through games, flashcards, quizzes, and cooperative learning activities. • Vocabulary-Rich Environment: Provide an environment that maximizes students' opportunities to learn new words by using sophisticated words, sharing your own favorite words, and incorporating fun games and activities. • Interactive Apps: Utilize vocabulary-building apps that offer interactive exercises, games, and quizzes to reinforce learning. • Vocabulary Challenges: Organize vocabulary challenges or contests that encourage students to use new words creatively. • Thematic Units: Organize units around specific themes or topics. This helps students see how words are related and provides context for repeated exposure.	Providing Multiple Exposures to Vocabulary: Watch educational consultant Anita Archer demonstrate teacher-led vocabulary instruction in a middle school language-arts class. Making It Stick: Memorable Strategies to Enhance Learning: Learn about the RIP toolbox for memory. The Vocabulary-Rich Classroom: Modeling Sophisticated Word Use to Promote Word Consciousness and Vocabulary Growth: In this article, learn about the research behind this approach and explore examples from teachers who have done it successfully.

ESSENTIAL PRACTICE 4:
PROVIDE DAILY STRUCTURED OPPORTUNITIES FOR SPEAKING AND LISTENING PRACTICE

DESCRIPTION

Providing daily structured opportunities for speaking and listening practice for MLLs in STEM is essential for language development, content-specific vocabulary acquisition, social and academic language skills, and overall academic and cognitive growth. Strong speaking skills enable students to effectively express their thoughts, share their knowledge, and engage in meaningful scientific discourse.

Engaging in **low-stakes** discussions, presentations, and collaborative activities allows MLLs to practice using English in STEM contexts, enhancing their fluency and communication skills. It is important to provide students with efficient time for preparation and practice before sharing in front of the whole class. When MLLs practice speaking with a partner, small group, or teacher, they can build confidence in language use and conveying their thoughts to others. This confidence empowers them to communicate their knowledge effectively, advocate for their ideas, and contribute to scientific conversations with clarity and conviction.

Effective communication is a two-way process that involves active listening. Through engaging in discussions, students learn to listen attentively, respect others' viewpoints, and respond thoughtfully. Active listening enhances their comprehension of complex STEM concepts, promotes empathy, and fosters a collaborative learning environment where everyone's voices are valued.

STRATEGIES & RESOURCES

PRACTICE	WHAT DOES THIS LOOK LIKE?	RESOURCES
Clear, concise directions and provide wait time	During instruction, simplify speech and directions and use concise language. Define terms and do not assume students already know. Provide more wait time for answering questions and provide opportunities to write first, then verbally share. • Simplify Language: Use simple language and sentence structures, avoiding complex sentences or idiomatic expressions when giving instructions. Break down instructions	11 Essential Strategies for Teaching English Language Learners: Explore a range of time-tested English language teaching strategies to support student learning. Video - Group Work and Group Discussions: Management in the Active Classroom: Example of how norms work to shape and guide academic talk.

	into smaller, sequential steps to avoid overwhelming students. • Repeated Instructions: Repeat important instructions, particularly for multilingual learners who might need more time to process and understand information. • Check for Understanding: Ask learners to paraphrase or repeat the instructions in their own words to confirm their understanding. • Provide Written Instructions: Write down instructions on the board or share them digitally to reinforce verbal directions.	
Scaffold Support	Scaffolding for speaking and listening involves a structured and supportive approach to help students develop effective communication skills. It's a process that gradually empowers students to engage in meaningful conversations, express their ideas, and actively listen to their peers. • Think-Pair-Share: Begin with individual thinking time, followed by discussion in pairs. This allows students to process their thoughts, share ideas with a partner, and gain confidence before contributing to a larger group discussion. • Sentence Starters or Frames: Provide students with sentence starters or frames to help them organize their thoughts and express themselves more coherently. For example, "I agree/disagree because..." or "One point I'd like to add is..." • Modeling: Demonstrate effective speaking and listening behaviors through role-play or teacher–student interactions. Model how to articulate thoughts clearly, maintain eye contact, and respond actively to others' contributions.	Scaffolds to Support English Language Learners in Writing and Discussion: Learn about different strategies to scaffold students with writing and discussion activities. Sentence Stems or Sentence Frames: Learn the difference between sentence stems and sentence frames, and explore examples of each.

	• Guided Questions: Pose open-ended questions that encourage critical thinking and extended responses. These questions should require students to provide evidence or examples to support their answers, promoting deeper discussions. • Gradual Complexity: Start with simpler speaking tasks and gradually increase the complexity of topics and activities as students become more confident and skilled.	
Collaborative Discussions	Foster collaborative discussions around STEM texts to deepen understanding and promote active engagement. Introduce structured discussion protocols, such as Socratic seminars, fishbowl discussions, or think-pair-share. These protocols provide a framework for participation, ensuring all students have an opportunity to contribute. • Socratic Seminars: A Socratic seminar is a student-led discussion format where participants engage in thoughtful dialogue about a specific text or topic, guided by open-ended questions and the practice of evidence-based responses, to promote critical thinking, active listening, and collaborative exploration of ideas. • Fishbowl Discussions: A fishbowl discussion is a structured conversational activity where a small group of students actively participates in a discussion while the rest of the class observes and takes notes. Typically, the inner circle (participants) engages in the discussion, while the outer circle (observers) watches and evaluates the conversation dynamics.	Collaborative Conversations: Speaking and Listening in the Primary Grades: Explore several strategies successful in enhancing the speaking and listening skills of a class of 28 first graders. More Talking in Class, Please: Strategies for facilitating small-group and whole-class conversations with students in grades three to twelve. Collaborative Culture: Academic Talk: Learn how norms, protocols, and practice all work together to make academic talk bloom successfully in your learning environment. Card Sorts: See how a high school social studies teacher uses a Card Sort to help students process important concepts.

	• Literature Circles: A literature circle is a student-led small group activity in which participants read the same book or text independently and then come together to engage in discussions about the content. Each member of the group takes on a specific role, contributing their insights and perspectives to explore different aspects of the literature.	6 Strategies to Help ELLs Succeed in Peer Learning and Collaboration: Learn how you can increase MLLs' peer collaboration and make their group work more successful with these strategies and recommended resources.
Presentation Opportunities	Provide regular opportunities for students to present their findings, projects, or research to their peers as if they were scientists, engineers, or mathematicians. This immersive approach provides a context for students to practice using disciplinary language and engage in authentic STEM discourse. • Prep Time: Provide time for preparation and practice in small groups prior to sharing in front of a larger group. • Scientific Symposia: Organize class or grade-level symposia where students present their research findings, experiments, or scientific concepts to their peers. • Engineering Design Showcases: Create engineering design challenges or projects that culminate in a showcase. Students present their design process, challenges faced, and solutions, emphasizing engineering principles. • Mock TED Talks: Have students prepare TED Talk–style presentations on a scientific discovery, engineering innovation, or mathematical concept. • Feedback forms: Provide structured opportunities for students to give feedback to their peers using feedback forms or rubrics that outline criteria for evaluating	Preparing Students to Take Their Presentations to the Next Level: Learn about four ways to prepare students to present dynamic presentations. How to Use Oral Presentations to Help English Language Learners Succeed: Learn how oral presentations can be used to support MLLs' language development in meaningful ways. How a Simple Presentation Framework Helps Students Learn: Learn how explaining concepts to their peers helps students build their content knowledge and improve their communication skills and learn a simple framework for presentations. Preparing Students for PBL Presentations: Explore strategies for preparing students for presentations. Plus, Minus, Next: Use this feedback protocol for peer feedback.

	oral presentations. Encourage MLLs to share their perspectives and findings, and provide constructive feedback and support to help them improve their speaking skills.	Feedback Practices and Strategies: Learn about practices and strategies teachers can implement to ensure that feedback to students is deliberate, planned, and focused on learning intentions and success criteria.
Technology Integration	Video recording platforms or voice recording applications can be used for students to practice and self-assess their speaking abilities. Use technology to facilitate virtual collaborations and communication with peers from different backgrounds, allowing for authentic and engaging speaking opportunities. • Podcasting: Have students write and record podcasts on topics of interest. They can script their podcasts, enhancing their writing skills while also practicing speaking and presentation skills. • Language Exchange Apps: Explore language exchange apps that connect students with native speakers for voice conversations, allowing them to practice speaking in authentic contexts. • Virtual Storytelling: Explore platforms like Flip, where students record and share short video stories or presentations, enhancing their speaking skills. • Virtual Reality (VR): Use VR platforms that simulate real-life scenarios, enabling students to practice speaking in immersive environments.	Creating Podcasts with Your Students: Learn about the steps of preproduction, recording, postproduction, and publishing. Help Your Students Make Your Own DIY Podcast: Learn how to incorporate podcasting into your curriculum. Flip: Create safe online groups for students to express their ideas in short video, text, and audio messages. Stop Motion Videos: Animated video that is captured one frame at a time, with physical objects that are moved between frames. Virtual Pen Pals: 5 Resources for Connecting Kids around the World: Explore five great virtual pen pal resources that connect kids around the world.

ESSENTIAL PRACTICE 5:
PROVIDE MULTIPLE OPPORTUNITIES FOR STUDENTS TO EXPRESS IDEAS, THOUGHTS, AND INFORMATION IN WRITING

DESCRIPTION

Writing in STEM allows students to clarify and deepen their understanding of complex STEM concepts and engages students in writing activities that reflect real-world STEM contexts, allowing them to apply their language skills in meaningful ways. When students articulate their knowledge and reasoning through writing, they engage in a process of reflection and organization to express their ideas, findings, and solutions clearly and concisely. This active engagement enables them to delve deeper into the subject matter, identify any gaps or misconceptions in their understanding, explore cross-curricular connections, and strengthen their conceptual knowledge.

Providing multiple opportunities for students, particularly MLL, to express ideas, thoughts, and information in writing allows students to practice and develop their language skills, including vocabulary, grammar, and sentence structure. By engaging in writing activities, they can reinforce their language knowledge and gain confidence in using English in academic and STEM contexts.

STRATEGIES & RESOURCES

PRACTICE	WHAT DOES THIS LOOK LIKE?	RESOURCES
Writing Across the Curriculum/ Authentic Writing Tasks	Engage students in writing activities that reflect real-world STEM contexts, allowing them to apply their language skills in meaningful ways. Designing writing tasks that connect to real-world scenarios and demonstrate the practical applications of writing skills can greatly engage students and enhance their understanding of subject content. These tasks give students a sense of purpose and relevance, enhancing their engagement and motivation to write in STEM. • Case Studies: Provide students with real or fictional case studies that require them to analyze a situation, make decisions, and communicate their findings effectively in	Think It, Write It: Creative Writing Across the Curriculum: Explore strategies and tools that students can use to write creatively across the curriculum. How Animal Research Can Inspire Elementary Students' Writing: Learn how one first-grade teacher assessed students' skills and knowledge by having them create books on animal facts.

	writing. This approach is especially effective in subjects like business, ethics, or social sciences. • Opinion Editorials (Op-Eds): Task students with writing opinion pieces on current events or issues related to the subject. This helps them practice persuasive writing while engaging with real-world debates. • Policy Proposals: Have students research and write policy proposals addressing real-world problems. This could be related to environmental issues, education reform, health care, or any subject area with policy implications. • Lab Reports: In science subjects, design lab report assignments that mirror the style and structure of actual scientific research papers. Students can write about experiments they've conducted, emphasizing methodology, results, and conclusions. • Business Plans: In economics or business classes, challenge students to develop business plans for entrepreneurial ventures. This involves research, financial projections, and persuasive communication. • Public Service Announcements (PSAs): Task students with creating PSAs related to subject-specific issues. This combines writing skills with visual communication and can be used for topics like health awareness, social issues, or safety precautions. • Scientific Reports for Authentic Audiences: Have students write scientific reports, research summaries, or infographics aimed at communicating complex scientific	3 Authentic Multimodal Projects for Young Writers: Learn ways to inspire young writers through meaningful writing projects. Other authentic tasks include a letter to a local government official, a brochure, a blog post, an editorial, a training manual, a field guide, or a one-pager about a topic.

	concepts to a general audience, showcasing their ability to make scientific knowledge accessible. • Technical Manuals or Instructions: In technical subjects, challenge students to create user manuals, guides, or instructions for using a specific tool or software. This reinforces technical writing skills. • Travel Journals: Task students with writing travel journals as they "visit" different historical periods, cultures, or locations related to the subject.	
Model Writing	Provide model writing samples that exemplify authentic writing relevant to the content areas. Analyze and discuss these samples as a class, highlighting effective language use, organization, and scientific communication conventions, and discuss how they effectively convey information, arguments, or ideas. • Think-Alouds: As you write, verbalize your thought process. Explain why you're choosing certain words, sentence structures, or ideas. This gives students insight into how experienced writers make decisions. • Shared Writing: Collaboratively write a text with your students. Solicit their input for content, sentence construction, and organization. This shows them how to compose a piece step by step. • Annotated Examples: Provide students with an exemplary piece of writing and annotate it with explanations of writing choices, techniques, and strategies used. • Drafting and Revising in Stages: Break down the writing process into stages (brainstorming, outlining, drafting, revising)	Modeling Writing and Revising for Students: Explore how a high school history teacher demonstrates the writing process for students by composing and editing an article while they observe. Teaching Writing Effectively: Modelled Writing: Learn what effective modelled writing should look like. Writing Instruction for ELLs: Explore several ideas and resources from veteran educators and researchers for students of all ages and proficiency levels.

	and demonstrate each stage separately, highlighting its purpose and strategies.	
Scaffolded Writing Activities	Provide scaffolding for writing activities by breaking down tasks into smaller, manageable steps. Offer graphic organizers, outlines, or templates to guide students in organizing their ideas before writing. These visual aids help MLLs structure their thoughts and ensure that their writing is coherent and well organized. • Sentence Starters: Provide sentence starters or sentence frames to help students begin their writing. For example, "One reason is...", "In the story, the character...", or "To illustrate this point...". • Graphic Organizers: Offer graphic organizers with labeled sections for introduction, body paragraphs, and conclusion. This helps students organize their thoughts and ideas before writing. • Guided Outlines: Provide students with an outline that includes headings and subheadings. They can then fill in the details for each section to create a structured essay. • Paragraph Frames: Offer frames for different types of paragraphs (e.g., introduction, body, conclusion) that guide students on what to include in each part. • Word Banks: Supply students with a list of relevant vocabulary words or phrases they can incorporate into their writing. This helps expand their language repertoire. • Highlighted Examples: Give students a sample paragraph or sentence that demonstrates the type of content, style, or organization you're looking for in their writing.	Using Scaffolds to Support Students in the Writing Process: Discover scaffolds to support each step in the writing process. Scaffolding Writing for Multilingual Learners: Learn about the stages of writing and how to provide supportive feedback. Teaching Academic Content and Literacy to English Learners in Elementary and Middle School: This practice guide provides four recommendations that address what works for English learners during reading and content area instruction. How to write a perfect 5 Paragraph Essay: Explore resources and tools to support students in writing a five-paragraph essay. Graphic Organizers to Help Kids With Writing: Discover four graphic organizers that can help kids organize their ideas in a very visual way. Video - Using Sentence Frames with ELLs: Listen to an ESOL specialist explain what a sentence frame is and how she might use this strategy with ELLs.

	• Sentence Expansion: Provide simple sentences and ask students to expand them by adding descriptive words, phrases, or clauses.	Story Starters - Creative Writing Prompts for Kids: Scholastic's Story Starters activity generates creative writing prompts, from general fiction to adventure, fantasy, and science fiction. 50 Writing Prompts for All Grade Levels: This collection of prompts asks young writers to think through real or imagined events, their emotions, and a few wacky scenarios. Scaffolds to Support English Language Learners in Writing and Discussion: Learn about different strategies to scaffold students with writing and discussion activities. Using Sentence Frames: Learn how to use sentence frames to organize ideas.
Peer Feedback and Revision	Implement peer feedback and revision activities to promote language development and improve writing skills. Encourage MLLs to exchange written work with peers, provide constructive feedback, and engage in revision. This collaborative process helps them see different perspectives, identify areas for improvement, and refine their writing based on feedback from their peers. • Modeling Revision: Show students how to revise a sentence by making changes for clarity, adding details, or rephrasing. • Peer Editing Checklists: Give students checklists with specific criteria they need to assess in their peers' writing. This	Try these feedback protocols with your students for peer feedback: • Sticky Note Feedback • Two Stars and a Wish • Plus, Minus, Next • The Tuning Protocol • Warm & Cool Feedback • de Bono's Thinking Hats • Checklists and Peer Editing VIDEO - 60 Second TAG Feedback: This strategy elicits quick feedback from peers on likes, questions, and critiques.

	encourages them to critically review and improve each other's work. • Revision Stations: Set up stations with different revision tasks (e.g., adding sensory details, checking for transitions) and have students rotate through them to improve their writing. • Gallery Walk: Display students' work around the classroom. Assign each student to review and provide written feedback on several pieces of work as they walk around. • Think-Pair-Share Feedback: Have students pair up and share their written feedback with a partner. This encourages peer discussion and ensures students receive diverse perspectives.	Teaching Students to Give Peer Feedback: In order for peer feedback structures to be effective, teach your students what helpful feedback is.
Reflection and Summarization	Incorporate reflection and summarization activities as a means for students to document their thought processes, observations, and reflections during STEM activities. This practice encourages metacognition, self-assessment, and the development of scientific writing skills. • Journaling or Writing Prompts: Provide students with regular opportunities to journal about their experiences, thoughts, and feelings. Use writing prompts that encourage self-reflection on specific topics or events. • Goal Setting: Teach students how to set realistic and achievable goals. Have them regularly assess their progress and reflect on the steps they've taken toward reaching those goals. • Mindfulness and Reflection Time: Integrate moments of mindfulness and reflection into the daily routine. This could be a few	Reflecting in STEM: Learn about the benefits of reflection in STEM. Exit Tickets: Explore how exit tickets can be used as an effective formative assessment tool and how they can promote the development of more profound student learning outcomes. Gaining Understanding of What Your Students Know: Explore how using quick, ungraded assessments can help educators know what learners understand from the day's lesson. Video - One Minute Sentence (Elementary): See fourth-grade bilingual students summarize their learning with One Minute Sentence.

	minutes of quiet time after an activity or at the beginning or end of the day. • Exit Tickets: An exit ticket is a quick informal gauge at the end of a lesson to help you assess whether students have "caught what you taught" and plan for the next lesson or unit of instruction. • One-Sentence Summaries: A one-sentence summary asks students to answer the questions "who does what to whom, when, where, how, and why?" about a given topic, and then to synthesize those responses into a single summary sentence. This forces students to focus on the main idea and vital details. • 3-2-1 Reflection: Students list three things they learned during the lesson, two things they found interesting, and one question they still have.	Video - One Minute Sentence (Secondary): Experience One Minute Sentence in a middle school science class Reflective Journals and Learning Logs: Learn more about reflective journals and the different types of reflections.
Use of Technology	Allow students to utilize technology tools such as online dictionaries, translation tools, and grammar checkers to support their writing. Use digital platforms to provide MLLs with opportunities to practice writing, receive immediate feedback, and engage in interactive writing activities tailored to their language proficiency level. • Translation Tools: Introduce multilingual learners to translation tools like Google Translate to help them understand unfamiliar words or phrases in their writing. • Collaborative Writing: Platforms like Google Docs allow multiple users to edit and collaborate on a single document in real time. Students can co-write, provide feedback, and revise collectively.	Writing Apps and Websites: Explore these great writing apps and websites for elementary students. LEGO Story Maker - A Great Digital Storytelling App for kids: Learn how to get your students using LEGO Story Maker to create multimedia stories. LEGO StoryTales Lessons: Find fun and engaging lessons for developing early language and literacy.

	• Blogging: Set up a classroom blog where students can publish their writing, such as personal narratives, opinion pieces, or creative stories. • Digital Storytelling: Use tools like StoryBird or Adobe Spark to create interactive digital stories that combine text, images, and multimedia elements. • Grammar and Writing Tools: Introduce students to grammar-checking tools like Grammarly or ProWritingAid to help them identify and correct errors in their writing. • Visual Organizers: Tools like MindMeister© or Coggle® allow students to create digital mind maps, concept maps, and flowcharts to plan and organize their writing. • Interactive E-books: Encourage students to create interactive e-books using tools like Book Creator or iBooks Author. They can add multimedia elements and engage readers in a dynamic way. • Virtual Author Visits: Arrange virtual visits with authors or writing professionals who can share insights about the writing process, creativity, and the publishing industry. • Editing and Revising Tools: Introduce students to tools like Hemingway App, which help analyze their writing for readability and suggest improvements. • Online Publishing Platforms: Use platforms like Medium, Wattpad, or Smashwords for students to publish and share their writing with a wider online audience. • Augmented Reality (AR) Writing: Explore AR apps that allow students to bring their	Makey Makey - Craft and Code Interactive Stories: Create buildings for an imagined city and tell the story of the people who live in your crafted buildings by coding stories. StoryBird: A digital platform that allows students to tell stories using words and images. Book Creator: A digital tool that enables students to create and read multimodal digital books.

	writing to life with interactive elements, enhancing engagement and creativity. • Virtual Language Experiences: Use virtual reality (VR) or AR apps to immerse students in language-rich environments, enhancing language exposure and learning.	

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Appendix 1. Resource Quick Guide

PRACTICE	RESOURCES
 **ESSENTIAL PRACTICE 1:** Create a welcoming and warm culture and climate	• 4 Ways to Build Relationships With Students Whose Backgrounds Differ From Yours • 5 Research-Based Tips for Providing Students with Meaningful Feedback • 5 Ways to Give Your Students More Voice and Choice • 21 Team-Building Activities for Students • A Collaborative Approach to Mistake Analysis With Older Students • Building Community With Restorative Circles • Connect Students' Background Knowledge to Content in the ELL Classroom • Empower Students Through Individual Conferences • Engaging Migrant Families • Even Geniuses Work Hard • Everyone Has an Accent | Learning for Justice • Feedback That Fosters Growth • Goal Tracker • How should ELLs be grouped for instruction? • How to Create a Welcoming Classroom Environment for ELLs • Making Sure Your Praise Is Effective • Partnering with Immigrant Families to Promote Student Success • Reflective Journals and Learning Logs • Starting a Heritage Language Book Club • Story Cubes • Teachers as Language Policy Planners • The Four Components of Morning Meeting • The Power of the Positive Phone Call Home • These are science's Top 10 erroneous results • Using Choice Boards to Boost Student Engagement • Using Videos to Give High School Students Personalized Feedback • Video: 60-Second Strategy: Community Circles
	• 20 Creative Ways to Check for Understanding • 6 Scaffolding Strategies to Use With Your Students • 8 Quick Checks for Understanding • Anticipation Guide

ESSENTIAL PRACTICE 2: Build background knowledge to create a foundation of knowledge and understanding.	• Background Knowledge and ELLs: What Teachers Need to Know | A step-by-step process • Concept maps • Carnegie Science Center - Virtual Field Trips and STEM Programs • Discovery Education - Virtual Field Trips • GLAD Pictorial Input Chart • Inquiry Lesson Plan Template • Integrating Language While Teaching STEM (ed.gov) • Let's Talk Science Resources • Maslyk's "Remaking Literacy" • NOAA | Hands-on Science Activities • Phenomenon Based Learning • Story Maps • T-Charts • The Power of Text Sets • The Nature Conservancy - Explore the World with Virtual Field Trips • Video - Quick ways to check understanding • Using Graphic Organizers with ELLs • Using Multimedia to Promote Vocabulary Learning: Supporting English Language Learners in Inclusive Classrooms • Video | Inviting Participation with Thumbs-Up Responses • Video: Comparing two texts with Venn diagrams • Video: English Learners in STEM: Interactive Graphic Organizer and Mix & Match • Video: Using "realia" to build background • What is PBL?
 **ESSENTIAL PRACTICE 3:** Actively and explicitly develop vocabulary familiarity and automaticity.	• 4 Ways to Teach Vocabulary and Reading Comprehension • 7 Activities When Creating Your Child's Vocabulary Journal • 10 Ways to Use Technology to Build Vocabulary • Accountable Talk Features and Language Stems • Bilingual Glossaries and Cognates • Bringing Words to Life by Isebel Beck • Classroom strategies: Vocabulary • Classroom Visuals and Supports • Connecting Word Meanings Through Semantic Mapping • Core Vocabulary Word Maps Examples • Frayer Model

	• How to Quickly Introduce New Topics or Vocabulary • Internalization of Vocabulary Through the Use of a Word Map Lesson Plan • Making It Stick: Memorable Strategies to Enhance Learning • Providing Multiple Exposures to Vocabulary • Realia Walls & Sentence Frames - Smithsonian Video • The Vocabulary-Rich Classroom: Modeling Sophisticated Word Use to Promote Word Consciousness and Vocabulary Growth • Use sentence frames to build academic language • Using Multimedia to Promote Vocabulary Learning: Supporting English Language Learners in Inclusive Classrooms • Visual Supports for Learning • Vocabulary Instruction: Strategies for the Classroom • Vocabulary Journal Template • Word Map • WWC | Teaching Academic Content and Literacy to English Learners in Elementary and Middle School (ed.gov)
 **ESSENTIAL PRACTICE 4:** Provide daily structured opportunities for speaking and listening practice.	• 6 Strategies to Help ELLs Succeed in Peer Learning and Collaboration • 6 Strategies to Help ELLs Succeed in Peer Learning and Collaboration • 11 Essential Strategies for Teaching English Language Learners • Card Sorts • Collaborative Conversations: Speaking and Listening in the Primary Grades • Collaborative Culture: Academic Talk • Creating Podcasts with Your Students • Feedback Practices and Strategies • Flip • Help Your Students Make Your Own DIY Podcast • How a Simple Presentation Framework Helps Students Learn • How to Use Oral Presentations to Help English Language Learners Succeed • More Talking in Class, Please • Plus, Minus, What's Next? • Preparing Students for PBL Presentations • Preparing Students to Take Their Presentations to the Next Level • Scaffolds to Support English Language Learners in Writing and Discussion • Sentence Stems or Sentence Frames

	• Stop Motion Videos • Video - Group Work and Group Discussions: Management in the Active Classroom • Virtual Pen Pals: 5 Resources for Connecting Kids around the World
 **ESSENTIAL PRACTICE 5:** Provide multiple opportunities for students to express ideas, thoughts, and information in writing.	• 3 Authentic Multimodal Projects for Young Writers • 50 Writing Prompts for All Grade Levels • Book Creator • Checklists and peer editing • de Bono's Thinking Hats • Exit Tickets • Gaining Understanding of What Your Students Know • Graphic Organizers to Help Kids With Writing • How Animal Research Can Inspire Elementary Students' Writing • How to Teach Students to Give Peer Feedback • How to write a perfect 5 Paragraph Essay • LEGO StoryTales Lessons • Makey Makey | Craft and Code Interactive Stories • Modeling Writing and Revising for Students • One Minute Sentence • One Minute Sentence • Plus, Minus, What's Next? • Reflecting in STEM • Reflective Journals and Learning Logs • Scaffolding Writing for Multilingual Learners • Scaffolds to Support English Language Learners in Writing and Discussion • Sticky Note Feedback • Story Starters: Creative Writing Prompts for Kids • StoryBird • Teaching Academic Content and Literacy to English Learners in Elementary and Middle School • Teaching Writing Effectively: Modelled Writing • The Tuning Protocol • Think It, Write It: Creative Writing Across the Curriculum • Two Stars and a Wish • Using Scaffolds to Support Students in the Writing Process • Using Sentence Frames • VIDEO: 60 Second TAG Feedback

	• Video: Using Sentence Frames with ELLs • Warm & Cool Feedback • Writing Apps and Websites • Writing Instruction for ELLs