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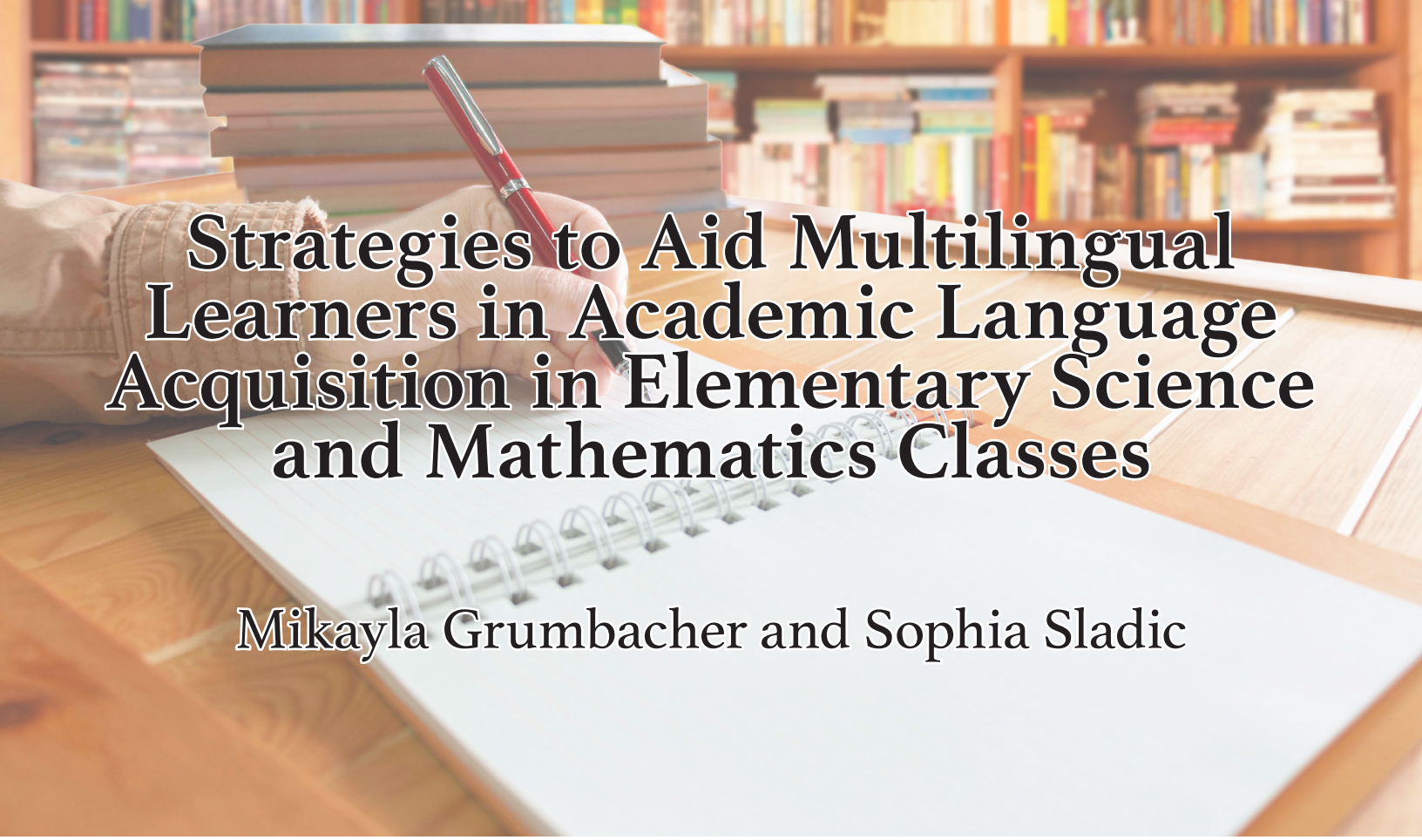

Strategies to Aid Multilingual Learners in Academic Language Acquisition in Elementary Science and Mathematics Classes

Mikayla Grumbacher and Sophia Sladic

Abstract

This qualitative inquiry research study surveys academic language acquisition strategies for teachers of multilingual learners in elementary science and mathematics classes. We paired readings of recent peer-reviewed journal articles with video observations of three elementary school teachers and an interview with a Director of English as a Second Language for a county in Virginia. Thematic analysis helped us identify similar strategies across the different studies, classroom observations, and interview. Our findings suggest that utilizing sensory and interactive supports are especially helpful strategies for teachers seeking to help multilingual learners in academic language acquisition.

Keywords: academic language acquisition, strategies, multilingual learners

Helping multilingual learners (MLs), particularly students whose primary language at home is a language other than English, achieve English academic language proficiency is important because it is a complex process. Academic language is the language used by students in school (Freeman et al., 2021). It takes five to seven years to develop language proficiency, so it is vital that teachers implement effective strategies (Freeman et al., 2021). Lan and de Oliveira (2019) explain that while it is difficult for all upper elementary students to learn academic language, it is even more difficult for MLs. Using this knowledge, it is not unfair to assume that MLs typically learn everyday social language faster because they hear it from their peers. The purpose of this study was to learn new strategies for academic language acquisition that we can implement in our future elementary classrooms. We, as future teachers, need to learn effective academic language acquisition strategies so our future students can be exposed to innovative methods that will make sense to them.

Before conducting our research, we had some assumptions. First, we thought it would be harder to teach individuals whose native language does not use the Latin alphabet because they have to adapt to a whole new alphabet in addition to a new grammar structure. Another assumption we had was that students who move to the United States later on have a harder time learning English academic language because they do not have sufficient exposure to the target language. We also assumed that English academic language is harder for students to grasp because they most likely will not be using it at home and therefore view it as something they only have to do in school. Similarly, we thought that academic language could be viewed as boring because it is mostly associated with specialized terms. We based our beliefs on our own English learning experiences, where we dreaded learning grammar because we found it unexciting. We also developed these assumptions from reading texts on K-12 learning and hearing experienced teachers describe some of their experiences working with MLs.

Both of our K-12 experiences lacked diversity, so we were not very familiar with the struggles of MLs. Our high schools were mainly white, and we experienced a white-washed educational format. We found that our teachers would present us with biased information or gloss over certain topics. For example, we were not taught about the dark side of America's "discovery" and how explorers conquered native tribes. Since we know we are not alone in missing out on a diverse student population and teaching approaches that value diversity, we believe it important to identify recent strategies that can help all students with their academic achievement. We want to ensure that our future students do not have the same experiences we did. They also deserve the ability to experience education in an individualized and interactive manner. As we went on in our research, we made our research focus more specific by looking at collaborative classroom strategies that ensured MLs learned from their peers. We specifically narrowed our focus down to elementary science and math because these content areas contain complex vocabulary. Our intent was to identify effective strategies that will help MLs with academic language acquisition in elementary science and mathematics classes.

Recent Literature

To form a basis for our research, we identified six recent, peer-reviewed journal articles that focus on MLs in upper elementary school and the strategies their teachers use to foster their learning in math and science classes. Two of the studies focused on math language, while the other four focused on scientific language. Across our six articles, some used the acronym MLs, while others used ELs (English learners), we use MLs for clarity throughout this paper. After reading and rereading our summaries of these six articles, we sought to synthesize common ideas that related to our topic. Two key themes emerged: teamwork in projects and experiments, and scaffolding materials.

Teamwork in Projects and Experiments

A study conducted by Pearce (2020) sought an effective technique to teach MLs about the complex topic of food chains. For the sake of consistency, the following passages addressing their research will continue to use MLs. The study took place at three elementary schools designated as Title 1 due to their low-income student population. About two thirds of the subjects were MLs, with the rest being native English speakers. The students were divided

into dynamic model groups and paper-pencil worksheet groups. The model depicted the trophic levels in the marine ecosystem as a Jenga block tower. Each block was labeled as specific producers, apex predators, and other science language terms. In the paper-pencil group, students used the same event card, but they used a chart on paper instead of an interactive model. The research question in this study dealt with the impact of the dynamic food chain model on ML academic language development. Pearce collected data from a reflection sheet filled out by the students after they completed either their activity.

Pearce's (2020) qualitative analysis of the student reflection sheets indicated that the dynamic model would be a helpful tool in classrooms. The students in the dynamic model group reported they learned new academic language tools, and they understood how the food chain is interconnected. When filling out the reflection sheets, some MLs included new words that they learned throughout the model activity. They were able to justify their understanding of these new words instead of merely listing them (Pearce, 2020). This shows that they felt comfortable enough to apply these new words into writing. In the paper-pencil group, both MLs and native English speaking students neglected to use new academic language words. For example, many used "animals" instead of "organisms." Not only did MLs in the dynamic model group learn new academic language terms, they also reported that they enjoyed it and had fun participating (Pearce, 2020). This activity prompted MLs to discuss with their groups what to do and not do with the blocks. They were able to verbally express their thoughts and use new academic language terms. In the end, Pearce advocated the use of dynamic models because it allowed students to interact and physically test their inquiries (Pearce, 2020).

Kelly (2016) described how a group of elementary school teachers collaborated to discuss challenges they encountered while trying to promote productive scientific conversations among their students. As a result of that discussion, the teachers created after-school STEM clubs and a summer STEM camp to find solutions that would increase students' ability to use academic vocabulary. The STEM clubs and the STEM camp were set up to help facilitate discussion among language learners in hopes of improving the students' academic vocabulary and their ability to meaningfully engage with the scientific concepts (Kelly, 2016). The teachers wanted to improve not only the students' scientific vocabulary, but also their scientific discussion and understanding. The teachers noted three strategies that worked particularly well: incorporating journal prompts, including ample teacher support, and using language stems (Kelly, 2016).

The first strategy used to help foster scientific discussions was incorporating journal prompts. Students were first asked to utilize the think-pair-share strategy. This included thinking independently, then sharing their ideas with a partner, and finally having mini class discussions on what each pair talked about and delving deeper based on the responses. The teacher added a step to the thinking part of this activity by having the students write down their thoughts through a journal prompt, which aided academic language acquisition (Kelly, 2016). The teacher gave both general guidance as well as an example of what each sentence should look like. The teacher also asked a question that the students could change into a sentence so it was easier for them. The journal prompt method gave the language learners more time to think and process, and having written notes helped them remember what was said during the sharing portion of the activity (Kelly, 2016).

The second strategy used included ample teacher support. The teacher started by asking focused questions to gain the students' attention on academic vocabulary. In this second strategy, teachers incorporated other skills beyond academic language, including paying attention, listening, and participating (Kelly, 2016). The teacher provided support by asking students to rephrase their peers' thoughts and elaborate on what was being discussed. Additionally, the teacher gave each student an opportunity to contribute (Kelly, 2016).

The third strategy utilized was the use of language stems, which are sentence starters or prompts that increase a language learner's confidence by giving them structure to use the academic language terms (Kelly, 2016). Teachers noted that there was an increase in actual scientific discussion when using this strategy. The teachers also highlighted the impor-

tance of translating the language stems into Spanish to minimize the language barrier. As a result, the students displayed increased engagement, better understanding of concepts, and improved academic vocabulary use (Kelly, 2016).

Continuing on the theme of teamwork, Lan and de Oliveira (2019) analyzed MLs in a fourth grade science classroom and their ability to "talk science." Specifically, this case study focused on an Asian student with limited English proficiency. Although she was able to speak and understand English when communicating with her peers, she was unable to attain the same level of proficiency when responding to her teacher's questions as part of scientific discourse inside the classroom. The article provided information on content-and-language integrated learning (CLIL) and more specifically information on how teachers need to switch between everyday and academic language. It also discussed context-embedded and written ways of learning. It was noted that in CLIL classrooms, there was a more traditional teacher-centered model of teaching rather than a student-centered approach. In addition, the CLIL classrooms had a relatively small focus on teaching academic language (Lan & de Oliveira, 2019). Lan and de Oliveira also noted that although it is necessary for teachers to transition between scientific and everyday language to enhance comprehension, this can be confusing for MLs.

Lan and de Oliveira (2019) identified three important connections. First, teachers should do more to help elementary students understand the language of science textbooks. Second, teachers with students who are MLs can and should move back and forth between science and everyday language in support of students' comprehension of science textbooks. Third, teachers should work to help students develop appropriate responses and engage in academic discussions.

Cunningham et al.'s (2021) study provided tips on how to include teamwork in projects by identifying six affordances, defined here as opportunities for action, to assist MLs. This article emphasized that engineering experiments provide opportunities for developing socially, practicing problem-solving, hearing diverse points of view, and using different modes of learning. For our purposes, we found the first, second, and fifth affordances to be the most important. The first affordance describes how teamwork in engineering experiments allows MLs to become motivated to practice their language skills. The second affordance expresses the importance of multimodal engineering experiments in the classroom. According to Cunningham et al. (2021), having the students draw, sketch, or write focuses less on forcing verbal language and helps improve their receptive language. The fifth affordance to engineering experiments for MLs is that they could draw from their diverse experiences, and contribute to the group by bringing their own cultural knowledge.

Scaffolding Materials

Irby et al. (2017) conducted a study of eight fifth-grade science classrooms that used academic language instructional practices in order to compare the practices observed in both the control and treatment classrooms to see if there were any statistical differences. The study also analyzed the frequency of academic language-based instructional practices used in the classrooms. In the control classrooms, typical instruction consisted of worksheets, ML questioning strategies, textbooks, vocabulary walls, and glossaries. In treatment classrooms, teachers used a more explicit approach in teaching new scientific concepts. In addition, teachers were trained to provide opportunities for students through group work, questioning strategies, and speaking activities (Irby et al., 2017).

The results revealed that both treatment and control classrooms used academic language effectively, but the instructional practices were greatly different. MLs in treatment classrooms had more opportunities to use academic language because they were given more opportunities to speak and interact with peers (Irby et al., 2017). This data highlights the vital nature of group interaction for MLs because of how it helps them adjust socially. When looking at the modes of communication, MLs in treatment classrooms saw improvement when verbal activities were accompanied by reading and writing activities. However, control classrooms implemented more English as a second language (ESL) strategies through their use of academic language. For example, teachers would purposefully group students at different levels of English proficiency into heterogeneous groups.The teachers would also write out language

scaffolds to help guide students to formulate their thoughts (Irby et al., 2017).

Irby et al. (2017) recommended that students should be explicitly taught academic language, like in treatment classrooms, while being given the opportunity to verbally use academic language and a variety of ESL strategies, like in control classrooms. Also, the researchers promoted the use of academic language in collaborative learning groups and in questioning strategies. The researchers advocated for increased opportunities to have coaching and mentoring strategies in order for teachers to learn specific pedagogical instructional methods (Irby et al., 2017).

Simpson Baird et al. (2020) discusses project Math and English Language Development (MELD) which also provided examples of scaffolding materials. The MELD program is geared towards supporting MLs as they develop academic language and mathematical knowledge. Simpson Baird et al.'s research study highlighted the importance of developing academic language, emphasized ELs' home language, and gave resources to make English learning more comprehensible. There was a three-year study where MLs made up about 20-25 percent of each of ten sixth-grade classes. The study consisted of focus groups questioning if specific MELD materials helped MLs learn academic language and math. The scaffolding materials included student glossaries, vocabulary mini lessons, lesson openings and closings, graphic organizers, homework activities, and cultural connection activities (Simpson Baird et al., 2020).

Simpson Baird et al.'s (2020) glossary technique utilized a student glossary that contained academic terms used in different math lessons, and the words were presented in the order that the specific lesson was given. Each glossed word had a space next to it to practice writing the word, and words occasionally came with pictures next to them. The students liked this method because it helped them learn new words, gave them a reminder, and reduced confusion. Lesson openings asked students to fill in the information they would be dealing with in the lesson in the beginning, and lesson closings served as a recap by requiring students to fill in the information presented in the lesson. Students had mixed feelings about this method because they were unfamiliar with some of the words. Graphic organizers aimed to help improve academic language because they can help organize information, and students can use them as an aid while reading. Students liked the layout of these because they helped them fill in the blank and understand academic language or mathematical terms (Simpson Baird et al., 2020).

Overall, the study conducted by Simpson Baird et al. (2020) provided an opportunity for student feedback on MELD materials, so the project team could work to improve their methods designed to build academic knowledge and skills in MLs. Teachers who implemented the MELD methods saw higher levels of confidence in their students because they were given tangible printed resources that helped them acquire new terminology and that they could acquire new terminology. The use of these printed materials gave students a physical aid that they could look back on whenever they needed a refresher.

Methods

We conducted a qualitative inquiry research study in order to learn about effective strategies for MLs to acquire academic language in elementary science and math classes. This method of study was appropriate because we did not deal with any quantitative data. This research method was also appropriate because we both came in with assumptions about the interest and ease of MLs learning academic language, and we sought to answer our research focus. We were interested in countering our assumptions, and discovering what particular strategies proved most effective to foster learning. According to Holland (2017), "inquiry requires students to engage in active learning by generating their own driving questions, seeking out answers, and exploring complex problems." None of these concepts are best observed using quantitative data.

Data Collection and Analysis

We collected data from three main sources. As previously discussed, we read and analyzed six peer-reviewed articles published in the last seven years. Next, we watched three videos of teachers posted on the Accomplished Teaching, Learning and Schools (ATLAS) website, which is a video database created by the National Board for Professional Teaching

Standards as a resource for teachers and those who are trying to become teachers. Each video implemented academic language acquisition strategies. The original videos were copyrighted in 2019 and 2014. The teachers in these ATLAS videos are National Board Certified, which is an advanced teaching license that exceeds state boundaries. We also conducted an interview with the ESL director from a Virginia county school. Her interview took place over the phone, and we asked her five open-ended questions:

1. How do you get a new ML to gain more confidence when learning academic language terms?
2. What are, if any, some resources/websites that you have used that provide academic language acquisition activities?
3. How can you encourage MLs to use academic language terms in a group setting?
4. What are some ways that you measure progress of academic language acquisition?
5. What are some ways you can relate academic language terms to that student's home language?

We used thematic analysis as we compared the concerns that emerged from our peer-reviewed articles with our field notes on the ATLAS videos as the transcript of our interview with the ESL specialist.

Findings and Discussions

After utilizing thematic analysis that involved reading and rereading all our data sources, we observed the following key themes: sensory supports and interactive supports.

Sensory Supports

All of the teachers we observed used visual cues, such as posters, PowerPoints, and videos. The ESL director we interviewed mentioned how she used a lot of in-class games on websites to serve as visual aids for learning. She would give the students QR codes so they could access the games from home, and she also used graphic organizers because she felt they helped students chunk and categorize information. Another method the ESL director used was the picture inductive model. It is a technique in which an educator provides a picture that is relevant to the current unit. Then, the class labels the picture together and breaks off into groups to try to create sentences using the labeled words from the picture. The first teacher we observed also utilized visual displays by showing a hand-drawn chart depicting two squares for a lesson on perimeter and area (Case 1619, n.d.). One square conceptualized the idea of area by having the rectangle fully colored in, and the other square showed perimeter by having each of the four sides bolded in a different color. The intention was to indicate to the students that they needed to focus on all four sides and their subsequent lengths. This teacher also responded to the needs of her students by incorporating worksheets and diagrams because the majority of her students were visual learners.

The third teacher we observed taught a lesson on whales and their habitats, and she used a PowerPoint with pictures (Case 1626, n.d.). The pictures helped students compare new terms to what they already knew. For example, when the teacher was explaining the spout of water coming out of the whale's blowhole, she also showed pictures of volcanoes and geysers to illustrate the similarities (Case 1626, n.d.). This access to visual cues made it easier for students to learn.

In addition, all of the teachers used hand gestures, chants, or songs to help students remember the new material. One of our teachers used hand gestures to illustrate newly-introduced concepts of perimeter and area (Case 1619, n.d.). This was accomplished by displaying the lyrics to a song about perimeter and area and then talking out the lyrics before singing them. As she sounded out the word perimeter, she moved her fingers in the shape of a rectangle. To represent the area, she waved her hand in a circular motion to illustrate filling in the inside of a rectangle. The teacher then prompted the students to join, and the class sang the song twice.

These examples support our finding that teamwork in projects and experiments is an effective strategy for academic language acquisition. Pearce's (2020) dynamic model helped groups or pairs acquire vocabulary terms by looking at blocks labeled as specific producers or apex predators by playing a game of Jenga. Additionally, Kelly (2016) praised the technique of think-pair-share. To foster scientific discussions, the STEM camp in Kelly's study had the

students think through journal prompts, then share ideas with their partners before having a class discussion about the responses.

Interactive Supports

While the teachers from the videos we observed were grouping the students together, they were not singling anyone out, and they had prior grouping combinations in mind. They would either group together mixed-ability students in order to help the students with lower proficiency levels, or they would group students of lower proficiency levels in order to provide extra help. Intentional grouping is beneficial because it allows the students to succeed through learning from one another.

According to the teacher in the first observation, she always pairs an advanced student with an emerging or developing English learner; this is known as mixed-ability grouping (Case 1619, n.d.). The approach enables the student to ask their partner questions in their native language if they are confused. The teacher in the second observation also used mixed ability grouping (Case 954, n.d.). The teacher in the third observation provided extra scaffolding to some of her pairs because she grouped them based on similar proficiency levels (Case 1626, n.d.). This teacher also walked around the class and directed some of the lower proficiency pairs to look at the cheat sheet for new vocabulary terms. She made sure she engaged equally with each group to not show favoritism.

Another interactive support the teachers used was the think-pair-share method. Students would pair up and talk about the questions provided by the teacher. The ESL director we interviewed called it "turn and talk." She uses it because she feels that it helps increase both content and language acquisition.The second teacher that we observed used the think-pair-share method as her primary instruction method during a lesson on the food web (Case 954, n.d.). While in their groups, they were able to use the visual cues on the board, which included scaffolding materials such as sentence starters and pictures. After allowing the students to work alone and then in pairs, the class then got back together as a whole and discussed the topic of food webs. The third teacher that we observed had pairs "pause, pair, share" using an inquiry chart with four questions (Case 1626, n.d.). The questions asked what students knew about whales, what they wanted to know, how they were going to find out this information, and why it was important to know about it. These questions served as a guide for research that students would conduct later on the computer or through using books (Case 1626, n.d.).

Our findings, that MLs were best assisted when teachers utilized sensory supports and interactive supports, coincide with the theme of scaffolding materials. The researchers varied in their methods of scaffolding, but a majority of the scaffolding materials involved visual cues. Irby et al. (2017) studied a type of classroom called control classrooms. This type of classroom consisted of word walls, which is a collection of academic language terms displayed on a wall or poster in bright, different colors in order to direct students' attention. Another research team at Project MELD used the visual scaffolding technique of graphic organizers, and the students responded well when graphic organizers were introduced in the classroom (Simpson Baird et al., 2020). They liked that they could use them to organize new information or words, and it was especially helpful for them to look at while they practice their writing.

Conclusion

Before we started this inquiry, we had a number of assumptions based on our own too-limited experiences as students in elementary classrooms. Our work to thematically analyze recent literature, classroom observations, and insights from an ESL specialist brushed these assumptions away, replacing them with key concrete strategies that aid MLs. Our study helped combat these assumptions as we explored strategies that could aid MLs in academic language acquisition in elementary science and mathematics classes. We conducted a qualitative inquiry research study in which we analyzed our six peer-reviewed recent articles, observed three lessons via ATLAS videos, and interviewed a language specialist. Our findings showed the varied use of sensory supports and interactive supports. We saw the use of sensory supports in both the articles and our observations. We also noticed the use of interactive supports in both the articles and our interview with the ESL director. Across our varied sources, these supports proved essential for academic language acquisition.

This information is useful to teachers of multilingual learners because it emphasizes the best strategies to help MLs succeed.

Limitations

We encountered some limitations as we researched academic language acquisition strategies. When we were collecting data, COVID-19 was still prominent, which prevented us from conducting any in-person interviews. As well, we did not get to observe any of the classrooms in person, which may have prevented us from seeing some of the flaws of the strategies. The videos posted to ATLAS are likely the best examples of certain teaching strategies, so they may have been biased or carefully selected samples. Another problem with the videos was that ATLAS does not explicitly mention what year the videos were recorded. We also only observed native Spanish-speaking students in the videos. We did not get to see if teachers had different approaches toward MLs who spoke a language other than Spanish. Due to these limitations, there is a possibility our case study sample was biased, and our research can not be generalized to other MLs who speak a language other than Spanish.

Implications for Future Research

After reflecting upon our research, we were left with questions that could be used as a foundation for future research. While reading articles and observing teachers, we gained vital information and strategies for academic language acquisition, but as we mentioned in our limitations, there is still room for more observation. Using the information we obtained, we wonder if strategies differ between content areas. For example, we saw similar strategies for acquiring mathematical and scientific terms, but would these strategies remain the same for acquiring historical terms? It is also likely that English classes would have entirely different techniques for fostering language acquisition. We also observed mostly Spanish-speaking classrooms, and Spanish and English have more cognates than English does with other languages. Therefore, another possible question to consider is how teachers do or do not adapt their academic language acquisition strategies for MLs whose native language is not Spanish.

Author's Note

Mikayla Grumbacher

Mikayla Grumbacher ('24) from Winchester, Virginia, is a Special Education major and a Teaching English as a Second Language (TESOL) minor. After graduation Mikayla plans on returning to Northern Virginia or the Shenandoah Valley to pursue a career in Special Education and continue her own education by seeking a master's degree. Her interests include volunteering as a mentor for Valley Scholars, tutoring for Gus Bus and the Migrant Education Program. In her free time Mikayla enjoys socializing with her friends, taking walks with her dog, and spending time with her family.

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Sophia Sladic

Sophia Sladic ('24) from Henrico, Virginia, is an Elementary Education major with a minor in Teaching English as a Second Language (TESOL). She plans to do another year of school to earn a master's degree in Elementary Education. Afterwards, she intends to teach for a few years before going back to school to study school counseling. Sophia believes that academic language is a difficult concept for multilingual learners to grasp, so she argues that it is vital for educators to implement creative and interactive techniques when they cover academic language.

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