Academic Content as a Vehicle for Language Learning: An Action Research Study Using Science and Social Studies to Develop Language for ELLs

KENDRA NUNAN
BRENDA CAPOBIANCO
Purdue University

Abstract

This study profiles an action research study conducted by a second-grade teacher examining the different ways of leveraging academic content such as science and social studies as a means of enhancing students' learning of language. The context of study was a second-grade classroom housed within a small urban school where student performance on both school- and district-based assessments indicated that ELLs were 10-20% lower than English only students. State-wide math and reading achievement for ELLs in this school was lower than the overall population, and ELLs had the lowest percentage of students meeting their annual growth goals. Action strategies included an array of proactive instructional activities focused on speaking and writing derived from both science and literacy education literature. Student performance was measured using NWEA scores and a teacher-created speaking evaluation. Results indicated that students demonstrated significant growth in the use and frequency of academic vocabulary. Lessons learned and recommendations for teaching ELL using academic content in the elementary classroom are discussed.

Key Words: ELLs, action research, science, social studies, language development

Introduction

The current climate of urban elementary education in the United States places high importance on student performance on standardized tests. The population of English Language Learners (ELLs) enrolled in U.S. elementary schools has grown exponentially over the last 20 years and will continue to grow for the next 20 years (Goldenberg, 2008). Many students in

urban school settings, who grow up speaking English, struggle to meet the expectations set by high-stakes testing. ELLs who are challenged by learning a new language and content simultaneously often struggle even more to meet the same expectations. Studies have shown that integrating language and high-interest content give students authentic contexts to develop English language (Santau, Secada, Maerten-Rivera, Cone, & Lee, 2010). There is a need for classroom teachers to be equipped not only with skills and strategies to support the growing number of ELLs in general education classrooms, but also the mindset that allows teachers to see their instruction through a new lens. Studies involving teachers as researchers of ELLs and content areas such as science, noted that teachers' perceptions of their skills and their students positively impacted their instruction (Langman & Fies, 2009; Manavathu & Zhou, 2012; Sowa, 2009). These factors led me, an in-service elementary school teacher, to investigate how I could change my views of my practice and support language development for my elementary school students. In this study, I used action research to not only better meet the needs of ELLs in my classroom but also improve my understanding of how to leverage academic content as a means of improving my students' learning of language. Action research is a methodological tool for practitioners to systematically improve their practices (Feldman, Altrichter, Posch, and Somekh, 2018). The process equips teachers (or other professionals such as social workers, nurses, etc.) with planning and reflective skills needed to solve or improve specific "problems" in their work. Action research invites teachers to make "important contributions to the knowledge base of their profession" (Feldman p. 6) by actively participating in the research practices. It involves reflective analysis and investigation of potential solutions for solving problems or enhancing specific teaching strategies. This is an effective tool for teacher researchers to use to improve teaching practices within their own settings and in purposeful situations. Through action

research, I hoped to find ways to meaningfully integrate academic language learning and science, social studies, or math content.

Origin of my research focus

After completing a graduate course on teaching academic vocabulary in context for ELLs, my perception of English Language Development (ELD) time shifted. Under Title VI (US Department of Education, 2018) law mandates that schools provide ELLs with 30 minutes of specific language instruction and support. Prior to attending the academic vocabulary course, I believed this time allocated for ELD should be spent on reading comprehension, test preparation, and evidence-based questioning, similar to our English only students' reading support time. The academic vocabulary course (and other previous graduate courses) emphasized the importance of utilizing discussion and conversation as a means of facilitating productive group work, especially for ELLs who are still building conversational and academic English vocabularies. I quickly realized that the support I was providing my ELLs was not in the areas that would make the greatest impact on their language development.

At the beginning of this action research study, I knew the ELLs in my classroom needed more direct support from me in their English Language Development time, specifically within the domains of speaking and writing. I knew that I had many effective strategies in my "teacher tool kit" and that I had experience with creatively and effectively integrating science and social studies content into my daily reading instruction. I wanted to find out how I could implement targeted language development lessons that addressed both English language skills and a math, science or social studies concept. My original research ideas and questions stemmed from the successful work of a Ohkee Lee and colleagues (Lee, Lewis, Adamson, Maerten-Rivera, & Secada, 2008; Lee, Maerten-Rivera, Buxton, Penfield, & Secada, 2009; Santau et al., 2010). In a

2008 study, teachers participated in professional development and subsequently integrated language development and rich science instruction. The demographics of the schools in this study mirrored those of my school, and the growth in student performance teachers and researchers observed was notable. I wanted to learn how I could replicate the big ideas of that study in my classroom. Which existing teaching strategies work well together? What new strategies should I implement? Which strategies encourage the use of new language? How do I make connections across the curriculum in order to give language genuine contexts? After reflecting further on my ideas, I narrowed my inquiry to the following guiding research questions: 1) what specific strategies can I use to encourage new language development in the context of academic content areas? and 2) how do those strategies impact my students' language use, speaking, and reading fluency?

Context

Many low socio-economic schools that have diverse student populations generally spend most of their instructional time focusing on math and language arts. This emphasis is due the way standardized tests scores impact individual teacher and school evaluations according to the Indiana Department of Education's RISE Teacher Evaluation and Development System (RISE, 2012). "Student Achievement" is one of the main components used to determine a classroom teacher's effectiveness. This includes student performance on state standardized tests that focus primarily on reading, writing, and math proficiency. School wide student achievemnt also caries weight in teacher evaluations. The RISE Teacher Evaluation Handbook explains that teachers need to "have a common mission of improving student achievement" and therefore "will also have a component of their evaluation score tied to school-wide student learning by following Indiana's A-F accountability model (RISE, p. 19). Consequently, little to no time is left for

science or social studies instruction in primary grades since neither subject is tested until fourth or fifth grade in Indiana.

Subgroups in our school population (such as ELLs, students receiving special education services, or students receiving free or reduced-price lunch) carry considerable weight in our school improvement plan. We (as a school) are held more accountable for these subgroups and the growth they demonstrate throughout the school year. Student performance on both school- and district-based assessments indicated that ELLs performed 10-20% lower than English only students. Statewide math and reading achievement for ELLs in our school was lower than the overall population, and ELLs had the lowest percentage of students meeting their annual growth goals. These statistics paint a disparaging picture and dictate the need for significant changes in the actions taken toward meeting goals outlined in our school improvement plan.

In my second-grade classroom, I worked with 22 students over the course of the school year. Five of those students were ELLs. There was one other ELL student in our grade level. He joined my small group for our daily ELD time. The students Individualized Learning Programs (ILPs) were based on World-class Instructional Design and Assessment (WIDA, 2019) scores. WIDA evaluates each student's language ability across five different domains: speaking, listening, comprehension, reading, and writing. A composite score is then assigned to each student. In my group, scores ranged from 1.0 (early language learner) to 3.2. A student at level 5 is considered linguistically "proficient" and students no longer receive direct language support when they reach and maintain this level. Three of the students in my small group moved from Mexico to the U.S. within the last two years. The other three students were born in the U.S. but lived in Spanish speaking homes. One student was identified with a specific learning disability (SLD). Half of the students qualified for free or reduced lunch.

Academic Content for Language Learning

Our small group met each morning at table in the back of my classroom. Another group of students met in the front of the classroom during this time block. The back table was a semi-circle shape with a cutout for a teacher chair in the center. This table made it possible for all students to see each other, the materials being used, and me as I facilitated lessons and discussions. The table was positioned in front of a wall where many classroom anchor charts (teacher created instructional posters) were displayed. This placement was intentional so that I could reference the anchor charts and foster curriculum connections throughout the lessons.

Overview of my instructional strategies

After gathering baseline student data from Northwest Evaluation Association (NWEA, 2019) and Edmentum (Edmentum, 2019) language arts tests, I developed a feasible action plan and formative assessment process that would help me make my daily ELD instruction valuable and effective. Our school improvement plan included goals for improved student performance on NWEA and WIDA for ELLs. My school's focus language domain for ELLs was speaking with appropriate academic vocabulary. In order to align my project with our school's instructional goals, I made improved speaking skills a targeted outcome for my action research. I also wanted to integrate the speaking goal with a specific content objective currently being taught whole-class. This content integration provided the authentic context in which to use new academic vocabulary.

When I sat down to plan out my research, I used my school curriculum map to guide my content choices. In order to build a deeper level of familiarity and comfort with key vocabulary and language concepts, I wanted to focus on the same content theme for two weeks. The content would support the most "linguistically challenging" language objectives for each two-week "mini unit." Each week began with a specific strategy that focused on speaking only. Often

times it included a picture sort or brainstorming lesson to encourage conversation and discussion

within our small group. Additionally, I included a strategy that focused on combining speaking

and writing, so that students could practice bridging the gap between speaking proper sentences

and writing proper sentences. In order to take proactive steps in improving my teaching, I used a

blend of strategies already embedded in my "teacher tool kit" and supplemented them with new,

research-based practices. These new activities were derived from science teaching literature,

ELL course textbooks, and ELLevation (ELLevation, 2019). Table 1 outlines the various

strategies I used and the frequency of each throughout the six weeks of data collection.

Table 1
Speaking strategies employed over six weeks.

Strategy	Frequency
Whole group discussion	12
State language and content objective	11
Sentence frames	11
Picture/Word Sort	9
Hands-on activities	9
Draw/sketches	6
Displayed language and content objectives	5
Backwards planning	4
Graphic organizer	3
Work with partner	6
Leveled questions	2
Highlighters	2
Video	1
Picture books	1

While I employed these different strategies over the six weeks of data collection, there

were several notable "gold mines" of instructional strategies I discovered. Gibbons' *Scaffolding*

Language, Scaffolding Learning (2015) was a required text for my graduate course on academic

vocabulary. This text outlined rationales, practical applications, and future implications for

second language development in content curriculum including an entire chapter on strategies for

collaborative group work. According to Gibbons (2015), "A group task should *require,* not

simply *encourage* talk," (p. 56). As a result, many of the action strategies I employed included

significant group or partner work. Picture sorts, such as, "Find My Partner," "Picture Sequencing," "Donut Circles," and "What Did You See?" (Gibbons, p. 64-73) include categorizing, sorting, describing, or analyzing pictures, and originated from Gibbons' chapter on collaborative group work. Gibbons (2015) emphasized the importance of well-organized group work because it gives students a shared experience and authentic context to use language. Taking all of this into consideration, I purposefully implemented strategies that would *require* conversation and provide opportunities to practice new language with purpose and appropriate context.

I reviewed literature on the use of picture books as a way to develop my students' familiarity with subject matter. *Teaching through Tradebooks* (Royce, 2019) provided examples of how to use picture books to make connections to seasonal weather patterns around the world. This resource inspired the use of a picture book during a unit focusing on fossils and the fossilization process. *Poetry by the Numbers* (Vardell & Wong, 2019) described a way to connect literacy and science through poetry. Students were encouraged to identify specific academic vocabulary that connected the poem to science. These cross-curricular integrations were essential for creating "cognitive hooks on which to hang new language" (Gibbons, p. 209).

When implementing my lessons, I planned for four days (Monday-Thursday) of direct instruction and practice. To assess prior language students had for a given topic, I started each week with a picture sort or description based activity. This allowed me to pinpoint specific academic vocabulary to target and support the rest of the week. Tuesday and Wednesday generally involved some type of task-oriented activity, such as magazine hunt, hands-on manipulative or drawing pictures with a graphic organizer. Thursdays often included a writing

task that connected to the sentence frames used in discussions from the previous days. This way, students practiced seeing, saying, and writing specific language.

Methods for data collection and analysis

There were several sources of data for my study. These sources included scores of student performance from school- and district-based testing (i.e., NWEA and WIDA tests). Additionally, I created and used a checklist to evaluate students' use of new content vocabulary and spoken language each week (see Table 2). For example, one task included pictures or manipulatives related to the content focus of that particular week. I worked with students individually, and I gave simple directions to prompt language and vocabulary. If students did not produce the vocabulary or language independently, I carefully asked guided questions. Students were "scored" on a 2-point scale for each vocabulary word or language sentence frame. Students who produced the language independently received a "✓+" (2 points). Students who produced the language after guided questions received a "✓" (1 point), and students who could not produce the language received "—" (zero points). The points for each vocabulary word or sentence frame were then totaled and written as a percentage.

Table 2
Speaking Assessment Checklist

Key Vocabulary	_____ face
	_____ hour hand
	_____ minute hand
	_____ o'clock
Sentence Frames	_____ The minute hand is on the 12.
	_____ The hour hand is on the 3.
	_____ It is 3 o'clock.
Bonus	_____ Explains why it is am or pm using references to 12:00, noon, midnight etc.
Total	_____/16 checkpoints
Notes	

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Using a school-wide percentage formula, the scores were recalculated to fit a four-point scale. Students scoring 85% or higher on the assessment received a score of 4. Scores from 75%-84% received a 3, 74%-50% a 2 and anything below 50% received a score of 1 (see Table 3). This table and 4-point scoring format was already used school-wide to represent student achievement on other classroom assessments and standards. I chose to adapt this tool for my research and data collection so that when sharing findings with colleagues, the data was presented in a familiar, "at a glance" format.

Table 3
Student performance on speaking assessments over six weeks.

	Speaking Assessments					
	Time		*Econ*	*Fossils*		*Life Cycles*
Week	1	2	3	4	5	6
Objectives	Describe features of a clock and read the time.	Describe activity and tell time/am or pm	Sort pictures of goods and services and explain	Sequence pictures and describe fossilization process	Retell fossil story using sequence words	Describe butterfly photos with compound sentences.
Student 1	4	2	4	2	3	4
Student 2	4	2	4	2	4	4
Student 3	2	1	4	2	2	4
Student 4	3	3	4	4	3	4
Student 5	3	3	4	4	3	3
Student 6	4	2	4	3	4	4

☐ 85% or higher (4)　　☐ 75%-84% (3)　　☐ 50%-74% (2)　　☐ Below 49% (1)

After reviewing the data at the end of week two, I realized I needed to be more careful in my planning and designing for assessments. The am/pm activities throughout the week did not line up with the language necessary to perform well on the assessment I designed. As a result, I used "backwards planning" to guide the rest of my lesson and assessment planning. I began by choosing key vocabulary and language I wanted students to use on the assessment. I then chose activities that would support those language skills throughout the week. This allowed me to

scaffold lessons appropriately, and state specific language and vocabulary in my objectives at the beginning of each lesson. I still used the picture sorting and categorization activities at the beginning of the week to help me determine what kind/how much support I would need to provide for the activities throughout the rest of the week.

At the end of our six-week data collection period, I re-administered the NWEA Language Arts test. NWEA is used district-wide for students to monitor growth in reading, math and language usage throughout the school year. Students took the test for the first time in August. A mid-year score was taken in December. I wanted to show growth using a tool that could be implemented by all teachers. Table 4 compares the growth my students showed between August and December (when no ELD instruction was given regularly) to the growth shown from December to April (when ELD time was given regularly and action strategies were implemented.)

Table 4
Student performance on NWEA across three-time intervals.

	August	December	April	Aug-Dec Growth	Dec-April Growth
			Performance on NWEA		
Student 1	156	160	179	4	19
Student 2	163	161	178	-2*	17
Student 3	158	156	200	-2*	44
Student 4	154	168	181	14	13
Student 5	152	162	184	10	22
Student 6	---	176	195	---	19
		Average Growth		+5.6	+22.3

*scores were included as "0" when calculating average growth

A case of significance

One student in particular became one of my exceptional students. Throughout the beginning of the school year, he said few words to me. He was more comfortable speaking in Spanish and would ask one of the other students to ask questions for him. On occasion I observed him raise his hand after I asked a question, but quickly pull it down before I had a

chance to call on him. After six weeks of receiving additional language support, he was regularly one of the first students to have his hand in the air, he answered questions with detail, and willingly told me stories about his weekends and jokes he came up with himself. In our small group, he actively participated in all discussions (almost to the point where he shared too much), and he helped other students figure out new words. When looking at his data points, he went from being the student with the lowest NWEA Language score in August, to a student with one of the highest scores in April. His strong work ethic, eagerness to learn, and the opportunities to practice his new language in a safe space provided him the platform he needed to be successful and exceed all of my expectations.

Findings

The purpose of my action research was two-fold: 1) identifying and implementing specific strategies that encourage new language development in the context of academic content areas; and 2) examining the impact these strategies made on my students' language use, spelling and reading fluency. Results from my action research indicated that I was able to generate and integrate a variety of skill-based strategies that supported my students' growth in language development. I was able to leverage my expertise in the content areas of science and social studies to incorporate key strategies that scaffolded my students' capacity to utilize vocabulary and spoken language fluently. Results from testing and my weekly checklist assessments indicated that students demonstrated significant growth by the end of six weeks. In short, my ELLs responded positively to my deliberate and purposeful instruction.

Lessons learned

For my conclusion, I share three key lessons I learned from my action research and supplement these lessons with recommendations for other like-minded educators of ELLs. First,

setting clear expectation was instrumental in facilitating growth among my ELLs. I noticed in the first week of my instruction I was not setting distinct expectations or objectives for the week's learning. In order to achieve shifts in both language and content learning outcomes, I needed to state explicitly these anticipated outcomes at the beginning of each lesson. Over the next few weeks of data collection, I found that it was beneficial to write these and post them on the wall behind the table where my small group met. Making the objectives clear and visible gave my students additional opportunities to practice seeing and saying the targeted skills and vocabulary. These objectives were also the guiding force when I made my assessments.

I recommend that teachers who are trying to serve their ELLs differently think about what content they want their students to learn and what language would accompany the learning of that content. Identifying key vocabulary that accompanies a particular science or social studies unit would be a good starting point. From there, choosing sentence frames or grammar forms that are important for discussing the given content will give ELLs support and tools for interacting appropriately with the content. Once key content vocabulary and language goals are established, teachers can begin planning specific language and content objectives.

Second, I found that my students' interests and participation increased significantly during the weeks focusing on science or social studies concepts. The second week of data collection focused on the concept of time. This was one of the weeks that did not include an engaging, hands-on activity or investigation. Consequently, students performed below the "norm" on that speaking assessment. On the other hand, students wanted to work hard during the weeks focusing on fossils, because we made our own candy "fossils" with layers of different types of bread. This indicated to me that giving students an engaging, high-interest exercise allowed them to apply knowledge of fossils and the fossilization process and make further

connections in the following week. In the same way, a life cycle unit provided students the opportunity to study and observe caterpillars. Students were excited to share and discuss their observations with me and with each other. The language objectives for those weeks were difficult (compound sentences) but their enthusiasm for the project helped them make connections to the challenging language task. I do not think I would have seen the same kind of growth in my students if we had focused on reading or writing and text-based questions for the six-week study.

I recommend teachers look for ways to integrate topics such as science and social studies in their ELD time. Stories from reading textbooks can be connected to science or social studies themes. These would be great opportunities to integrate new content and make connections across the curriculum. Using science and social studies themes also creates room for different types of engaging activities that can be completed in ELD time. Teachers can use more hands-on lessons or picture sorts with new content. These strategies are effective and do not always require extraneous preparation time.

Finally, the most important lesson I learned from this study is the importance of small group discussion. Not only are discussions essential for students to develop spoken language, but also these small group interactions with me as the teacher totally changed how students interacted with me during whole class activities. The lessons aligned with language or content topics that were also taught to the whole class. Spending time during ELD lessons on the same topics gave ELLs exposure to vocabulary and concepts. Because of the "sneak peaks" this small group received; they often were the first ones to raise their hands when I later introduced the lessons to the rest of the class. I also observed a positive shift in students' confidence and comfort in the classroom. Students who were initially shy and quiet early in the school year

quickly blossomed into new versions of themselves. They were more willing to tell me stories and share more challenging questions in class. I think this came from spending time in a small group where they felt safe to practice their new language. In our small group time, I also had more opportunities to ask them about their lives outside of school, their interests, and how they made connections to what we were learning. Without those opportunities to develop deeper student-teacher relationships, I question whether or not I would have observed the same increased levels of participation from my ELLs during whole-group instruction.

Another benefit of having regular small group discussions is that the students in this small group learned how to be effective members of a small group. What I mean is that they understood how to listen well and respectfully answer their friends' questions. When reading or talking about a particular process or concept, students often jumped in and explained the concept in their own way; helping themselves by articulating processes in a new way and helping their classmate understand. The students in this group were kind and considerate, and worked hard not to interrupt each other or "take control" of the group conversations.

While ELD instruction can take place any time throughout the school day, I recommend establishing regular routines for meeting with ELLs. The relationships and trust that formed in the safe space of regular, small group discussions had a profound impact on my students. These student-centered conversations not only built familiarity with the people in the group, but also the content and subject areas being studied. I chose to have my group meet during our daily reading intervention time. When I tried to implement ELD strategies in the fall outside of this time block, I rarely followed through. In order to hold oneself accountable, I recommend implementing ELD time during a regular small group time block such as a reading or math intervention time.

ABOUT THE AUTHORS

Ms. Kendra Nunan is a second-grade teacher at Murdock Elementary in Lafayette, Indiana. She is pursuing a Master's Degree in Elementary Science at Purdue University. Ms. Nunan's research background includes using action research to determine strategies that support language development using science and social studies content. Ms. Nunan continues to advocate for English Language Learners in mainstream classrooms through leading a school-based professional learning community and continuing her action research studies.

Dr. Brenda Capobianco (Ed. D) is a Professor of Science Education and Engineering Education (courtesy) at Purdue University. Dr. Capobianco's research interests include elementary science teachers' integration of the engineering practices and young women's participation and identity development in engineering education. Dr. Capobianco is the Director of the *Science Learning through Engineering Design (SLED) Partnership* and teaches the undergraduate elementary science methods course and graduate courses in gender and culture in science education and teacher action research.

Inquiries can be made to Kendra Nunan: knunan@lsc.k12.in.us

References

Edmentum. (2019). Retrieved from https://www.edmentum.com/

ELLevation. (2019). Retrieved from https://ellevationeducation.com/home/wida

Feldman, A., Altrichter, H., Posch, P., & Somekh, B. (2018). *Teachers Investigate Their Work*. https://doi.org/10.4324/9781315398822

Gibbons, P. (2015). *Scaffolding Language Scaffolding Learning*. (H. Price, Ed.) (2nd ed.).

Portsmouth: Heinemann.

Langman, J., & Fies, C. (2010). Classroom response system-mediated science learning with English language learners. *Language and Education, 24* (2), 81-99. https://doi.org/10.1080/09500780903096553

Lee, O., Lewis, S., Adamson, K., Maerten-Rivera, J., & Secada, W. G. (2008). Urban elementary school teachers' knowledge and practices in teaching science to english language learners. *Science Education*, *92*(4), 733–758. https://doi.org/10.1002/sce.20255

Lee, O., Maerten-Rivera, J., Buxton, C., Penfield, R., & Secada, W. G. (2009). Urban elementary teachers' perspectives on teaching science to english language learners. *Journal of Science Teacher Education*. https://doi.org/10.1007/s10972-009-9133-z

Manavathu, & Zhou, (2012).The impact of differentiated instructional materials on English Language Learner (ELL) students' comprehension of science laboratory tasks. *Canadian Journal Science, Mathematics, and Technology Education, 12,* (4), 334-349. https://doi.org/10.1080/14926156.2012.732255

Northwest Evaluation Association. (2019.) Retrieved from https://www.nwea.org/

RISE Evaluation and Development System: Evaluator and Teacher Handbook Version 2.0 (n.d.) Retrieved from https://www.doe.in.gov/sites/default/files/evaluations/rise-handbook-2-0-final.pdf

Royce, CA. (2019). Seasonal Weather Patterns, *Science and Children*. (February), 20–26. https://doi.org/10.2505/4/sc19_056_06_20

Santau, A. O., Secada, W., Maerten-Rivera, J., Cone, N., & Lee, O. (2010). U.S. urban elementary teachers' knowledge and practices in teaching science to English language learners: Results from the first year of a professional development intervention.

International Journal of Science Education. https://doi.org/10.1080/09500690903280588

Sowa, P. A. (2009). Understanding our learners and developing reflective practice : Conducting

action research with English language learners. *Teaching and Teacher Education*, *25*(8),

1026–1032. https://doi.org/10.1016/j.tate.2009.04.008

Vardell, B. S., & Wong, J. (2019). Poetry of science: Poetry by numbers. *Science and*

Children,56 (6), 19. https://doi.org/10.2505/4/sc19_056_06_19

World-Class Instructional Design and Assessment. (2019.) Retrieved from https://wida.wisc.edu/

United States Department of Education Office of Civil Rights (2018). Retrieved from

https://www2.ed.gov/about/offices/list/ocr/ell/legal.html