Academic Language Acquisition

Rebekah Feller

Capstone Project

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Section One

Introduction

This Capstone Project is an in depth analysis of Academic Language in schools pre-kindergarten through twelfth grade. Academic language, or the language used within schools, can vary between school subjects and oral and written discourse. Academic language is a relatively new topic gaining relevance with the implementation of the Common Core State Standards (CCSS). As a result of the cross-curricular characteristics of academic language, and the demand for it to be used from pre-kindergarten to twelfth grade, it is essential that teacher educators become more knowledgeable in the many uses of academic language.

Problem Statement

"A large and rich vocabulary is the hallmark of an educated individual" (Beck, McKeown, Kucan, 2002, p. 1)

Given the increased expectation and rigor of academic language in schools, teachers need to become more familiar and fluent in academic language across content areas. According to Uccelli, Barr, Dobbs, Galloway, Meneses, & Sanchez (2014) "academic language proficiency has long been hypothesized to contribute to school success, especially to comprehending school texts in the upper elementary school years and beyond" (p. 6). Often teachers will freely teach vocabulary if they believe a "difficult" word has come up, but do not plan explicit, routine vocabulary instruction into each subject. Beck, McKeown, and Kucan (2002) believe that "development of these facets of word learning cannot just rely on student spontaneously reengaging with words on their own, as it simply will not occur in many cases. Rather, these facets must be the direct focus of instructional conditions. It has been our experience that students become interested and enthusiastic about words when instruction is rich and lively, and

that conditions can be arranged that encourage them to notice words in environments beyond school" (p. 13). In addition, Beck, McKeown, and Kucan argue that just providing information will not result in "deep sustained knowledge of a word" (p. 32). Students need multiple encounters over time so that they are able to move beyond a "temporary surface-level understanding and if new words are to become permanently and flexibly represented in students' vocabulary repertoires" (p. 32).

As the CCSS have given increased weight and importance to academic language in order to be college and career ready, teachers need to adopt research-based strategies to teach vocabulary. In addition, educators need to know their responsibilities of teaching academic language in the content areas and how to give the best instructional practices to the English Language Learners in their classrooms.

Significance of the Problem

Due to the recently implemented Common Core State Standards (CCSS) adopted in New York State in 2010, there has been a heightened awareness of the need for children to develop academic language in pre-kindergarten to twelfth grade classrooms. Academic language has many definitions. Due to the complexity, versatility, and diversity of academic Language it is hard to come up with just one definition (Zwiers, 2014). According to Sato (2011) academic language is defined as "the language (e.g., lexicon, grammar, discourse features and functions) that students need to access, meaningfully engage with, and achieve rigorous academic content as they prepare for college and careers" (p. 6). Academic language proficiency is "knowing and being able to use general and content-specific vocabulary, as well as specialized or complex

grammatical structures – all for the purpose of acquiring new knowledge and skills, interacting about a topic, or imparting information to others" (Bailey, 2007, p. 42).

Goldenberg (2008) explains that academic English is

"a term that refers to more abstract, complex, and challenging language that will eventually permit you to participate successfully in mainstream classroom instruction. Academic English involves such things as relating an event or a series of events to someone who was not present, being able to make comparisons between alternatives and justify a choice, knowing different forms and inflections of words and their appropriate use, and possessing and using content-specific vocabulary and modes of expression in different academic disciplines such as mathematics and social studies" (p. 2)

For the purposes of this paper I will use the Common Core State Standards definition of academic language labeling the words with Tier One, Tier Two, or Tier Three. Tier One words are "the words of everyday speech usually learned in the early grades, albeit not the same rate by all children" (National Governors Association Center for Best Practices [NGA Center] & Council of Chief State School Officers [CCSSO], 2010b, p. 33). General academic words and phrases are "vocabulary common to written texts but not commonly a part of speech" (NGA Center & CCSSO, 2010b, p. 42). General academic words and phrases are equivalent to Tier Two words and phrases. Domain-specific words and phrases are "vocabulary specific to a particular field of study (domain), such as the human body…in the standards, domain-specific words and phrases are analogous to Tier Three words" (NGA Center & CCSSO, 2010b, p. 42).

Academic language is significant because of the college and career readiness standards that are included throughout the Common Core State Standards. It is difficult for students to attain and use academic language because it differs from "every-day" spoken language. Students often struggle to communicate at school in instances where academic language is required

(Halliday, 2004).

Purpose

      The purpose of this capstone project will be to integrate the findings of research studies

and published literature into the realm of academic language acquisition. The research and

synthesis of the topic educated myself, an educator in the field, about the use of academic

language and the best practices in using it. Furthermore, this analysis will allow me to give

professional development sessions about academic language, an area of need in today's schools.

On account of New York State passing the CCSS, current and future teachers need to be

informed of strategies to employ into their classrooms. Additionally, this analysis has multiple

themes or threads throughout pertaining to the different uses for academic language, which

increases its relevance to the whole teaching field (see Appendix A).

Research Questions

      The research question of this capstone project shall be: How did the writers of the

Common Core State Standards justify the use of academic language in college and career

preparedness? How is academic language taught in the content areas? What does research say

about academic language and English Language Learners? What are the best practices in

teaching and applying academic language in pre-kindergarten-sixth grade, and seventh-twelfth

grade?

Background to the Study/Personal Rationale for this Study

      I pursued a capstone project in academic language because it is a very new, relevant topic

in today's field of education. Throughout the school day, I have noticed academic language

mentioned in the various curriculums I teach in math, English language arts, and science/social

studies. Likewise, my undergraduate college courses stressed the importance of using and

incorporating academic language into our lesson plans, most specifically in our edTPA student

teaching unit plans. Yet, after graduating with my Bachelors degree, I felt like I only "scratched

the surface" of academic language, and was not well enough equipped to teach it thoroughly in

the classroom. With the completion of this capstone project and experience in the classroom it is

my aspiration to become an expert in academic language acquisition.

Study Approach

        This capstone project was achieved by using a systematic review. The purpose of a

systematic review is "to sum up the best available research on a specific question. This is done

by synthesizing the results of several studies" (Campbell Collaboration, 2014, para. 1). A

systematic review is attractive because after research questions are created, a large number of

studies are reviewed and the evidence is summarized and evaluated. A systematic review

requires criteria for selecting studies, and then appraises and synthesizes all relevant studies on a

particular topic. In this study I found that new research has been published regularly throughout

2014 and 2015. The publication of new research is exciting and proves that this is a relevant

topic. However, this study only includes studies published up until March 2015.

Positionality

        I grew up and currently live in a rural area of western New York. I attended the College

at Brockport (SUNY) for my undergraduate education in History with certification in Childhood

Education B-6 and Special Education B-6. Upon completion of my Bachelor's degree, I began to substitute in all of the schools in my county while starting my Master's degree in Literacy B-12 at Brockport. In the fall of 2014 I started a long-term substitute position at a rural district near home. I began as a consultant teacher for kindergarten and first grade, then moved on to a third grade general education position, and currently I am in a sixth grade compartmentalized position teaching ELA and science.

I believe that literacy encompasses every aspect of learning in a school day. My aspiration is to be a life-long learner and this project has allowed me to further study a topic that interests me and will have an impact on my future teaching.

Methods of Data Collection

The methods of data collection I used for my capstone project was primarily the Drake Memorial Library's online database systems to find research studies, peer-reviewed journals, and books about my topic. I searched all key words related to academic language acquisition, common core, content area vocabulary, and language strategies. In addition, Inter-library loan was a great resource to supplement the texts already found in the Brockport library archives.

Procedures

The major themes and research questions of this study were developed in the fall semester of 2014. The themes are: The common core and academic language, content areas and academic language, English Language Learners and language acquisition, and strategies for teaching academic language. Research was gathered between November 2014 and March 2015. Synthesis of the research occurred in April 2015. Research was gathered using resources from

the College at Brockport's Drake Memorial Library and interlibrary loan.

Criteria for Trustworthiness

The criteria for trustworthiness for the capstone project was the use of a well-recognized research method (systematic review), and used debriefing sessions between the researcher and the superior in order to maintain credibility (Shenton, 2004, p. 64). In addition, the study had good transferability by providing background data to establish the context of the study (p. 69). The study has confirmability by the recognition of shortcomings in the study's methods, and the potential effects (p. 72).

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Section Two

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The Common Core State Standards and Academic Language

The Common Core State Standards were released in 2009, with the goal that every student would be ready to graduate from high school equipped with the skills and knowledge necessary to succeed in college, career, and life. Since then, 43 states have adopted the Common Core State Standards (CCSS) for both English Language Arts (ELA) and Math. For many years, the issue of education standards reform has been brought to the public eye. The CCSS were released to allow the United States to gain ground in international education. Before the CCSS, a perceived negative aspect of American education was that each state had different standards. The CCSS were created to generate uniformity across each state and make it clear what is expected in every grade level (National Governors Association Center for Best Practices [NGA Center] & Council of Chief State School Officers [CCSSO], 2010a).

The Common Core State Standards for English Language Arts and Literacy in History/Social Studies, Science, and Technical Subjects Appendix A provides data from research

supporting the key elements of the standards. The first issue discussed in the document was text complexity. Text complexity is "the inherent difficulty of reading and comprehending a text combined with consideration of reader and task variables" (NGA Center & CCSSO, 2010b, p. 43). The NGA Center and CCSSO state evidence from the ACT college admissions test showing that students who did well were able to answer questions associated with complex texts. The authors go on to say that college demands and the complexity of texts have increased over the past half-century and when converted into Lexile scores, the college readings exceeded grade 12 complexities significantly. The authors argue that the problem with the Lexile gap is that students in college must work more independently, and are provided less scaffolding. Due to the gap between high school and college text complexity, the document cites that only half of the students who took the 2004-2005 and 2008-2009 ACT test met the benchmark score in reading (NGA Center & CCSSO, 2010b).

Appendix A continues citing in depth evidence about the gap between high school and college Lexiles and how low adult reading levels are. To address the gap, and to help students to be able to read complex texts independently, the standards suggest an approach to text complexity. The standards give a three-part model for measuring text complexity (figure 1): qualitative dimensions, quantitative dimensions, and reading and task considerations. Under qualitative measures of text complexity is the first mention of academic and domain-specific vocabulary. Found under the heading "Language Conventionality and Clarity" is "Texts that rely on literal, clear, contemporary, and conversational language tend to be easier to read than texts that rely on figurative, ironic, ambiguous, purposefully misleading, archaic or otherwise unfamiliar language or on general academic and domain-specific vocabulary" (2010b, p. 5). When determining text complexity, academic/domain-specific vocabulary needs to be considered.
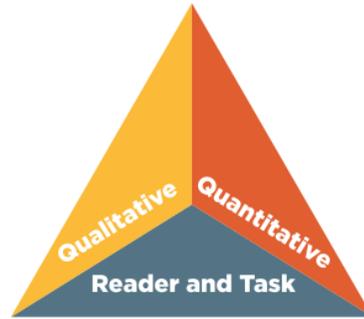
Figure 1: The Standards' Model of Text Complexity

Figure 1: (NGA Center & CCSSO, 2010b, p. 4)

Continuing on through Appendix A, one will find a hefty section about vocabulary. The authors begin with compelling evidence that the importance of students acquiring a rich and varied vocabulary cannot be overstated. The document notes that the difference in students' vocabulary levels is "a key factor in disparities in academic achievement", and that "vocabulary instruction has been neither frequent or systematic in most schools" (2010b, p. 32). Based off of Beck, McKeown, and Kucan's 2002 and 2008 research, the CCSS use a model for conceptualizing categories of words readers encounter in texts. These researchers (Beck, McKeown, and Kucan) categorize words into three tiers. Tier One words are "the words of everyday speech usually learned in the early grades, albeit not the same rate by all children" (2010b, p. 33). Tier Two words are general academic words and are found more often in written texts. Tier Two words that might be found in informational texts might include "relative, vary, formulate, specificity, and accumulate" (2010b, p.33), while Tier Two words in a literary text might include "misfortune, dignified, faltered, unabashedly" (2010b, p.33). Tier Two words can be thought of more specific ways to say things such as "saunter instead of walk" (2010b, p.33). Tier Three words refer to domain-specific words and are specific to a field of study. Examples would be "lava, carburetor, legislature, circumference, aorta" (2010b, p. 33). Tier Three words

are more commonly found in informational texts and are words that usually need to be

scaffolded and repeatedly used.

It is interesting to note that the authors of the standards highlight the importance of Tier

Two words. When planning for lessons, teachers often focus only on Tier Three words and

reinforce them throughout the lesson. Tier Two words are not tied to a particular discipline and

are not the clear responsibility of a specific content teacher. Since Tier Two words are not unique

to a particular discipline, they are less likely to be explicitly taught by teachers. The underlying

problem is that Tier Two words are likely to be found in complex texts, and are less likely to be

defined within a text by context clues. Based on the evidence above, it is important that teachers

focus on both Tier Two and Three words (2010b, 2010).

Appendix A gives examples of *Tier Two* and **Tier Three** in context by giving annotated

samples. In this paper, *Tier Two* words will be written in *italics,* and **Tier Three** words will be

written in **bold** letters. One example is an excerpt from *Volcanoes* (Grades 4-5 Text complexity

Band):

> "In *early times*, no one knew how **volcanoes** *formed* or why they *spouted red-hot*
> **molten** rock. In *modern times*, scientists began to study **volcanoes**. They still don't know
> all the answers, but they know much about how a **volcano** works.
>
> Our planet is made up of many *layers* of rock. The top *layers* of *solid* rock are called the
> **crust.** Deep beneath the **crust** is the **mantle**, where it is so hot that some rock melts. The
> melted, or **molten**, rock is called **magma**.
>
> **Volcanoes** are *formed* when **magma** pushes its way up through the crack in Earth's **crust**.
> This is called a **volcanic** *eruption*. When **magma** *pours forth* on the *surface,* it is called
> **lava**."
>
>   (Simon, Seymour, Volcanoes. New York: HarperCollins, 2006)

In the above excerpt, the Tier Two word *layers*, is important in order to grasp the meaning of the

crust. Other important Tier Two words are *spouted* and the phrase *pours forth*. Pours and pours

forth need to be understood to "visualize the action of a volcano" (2010b, p. 34). In *Volcanoes*,

the Tier Three words often repeat, which is true of Tier Three words in most academic texts,

"**Volcano(es)** appears four times—five if **volcanic** is counted" (2010b, p. 34). The authors point

out that in this text and many others, Tier Three words are provided "generous support in

determining meaning, including explicit definitions and repetition and overlapping sentences"

(2010b, p. 34).

The example above illustrates the importance of all three tiers of words. It is necessary

for students to comprehend the text fully. The shift produced by the CCSS prompts teachers to

offer more targeted instruction with Tier Two and Tier Three words. Beck, McKeown, & Kucan

(2002) offer questions for teachers to consider when selecting words for explicit instruction. The

questions include:

- How generally useful is the word? Is it a word that students are likely to meet often in

  other texts? Will it be of use to students in describing their own experiences?

- How does the word relate to other words, to ideas that students know or have been

  learning? Does it directly relate to some topic of study in the classroom? Or might it add

  a dimension to ideas that have been developed?

- What does the word bring to a text or situation? What role does the word play in

  communicating the meaning of the context in which it is used? (p. 29)

Teachers can use the questions above to help them decide which words need clear

instruction. I believe that choosing the Tier Two and Tier Three words is the hardest part of

academic language instruction.

The Common Core State Standards that connect to academic vocabulary are found in

both the reading and language strands. Reading anchor standard 4 states: "Interpret words and

phrases as they are used in a text, including determining technical, connotative, and figurative

meanings, *analyze how specific word choices shape meaning or tone*" (NGA Center & CCSSO,

2010a, p. 10). The language anchor standard 4 includes, "Determine or clarify the meaning of unknown and multiple-meaning words and phrases by using *context clues, analyzing meaningful word parts,* and *consulting* general and specialized *reference materials* as appropriate" (2010a, p. 25). Finally, language anchor 6 contains "Acquire and use accurately a range of general *academic* and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate *independence in gathering vocabulary knowledge* when encountering an unknown term important to comprehension or expression" (2010a, p. 25).

Academic Language and the Content Areas

Academic Language is not limited to English Language Arts (ELA). Academic language is essential to content area instruction. The following section will look at integrating academic language into the content areas and implications for instruction. It is key to remember that academic language is more than specific content vocabulary words. Academic language represents all language used in academic situations in elementary and secondary schools (Short, Vogt, & Echevarria, 2010). Many content area teachers in the secondary level recognize that they need to teach content-specific Tier Three words, but many do not know that they should be also teaching Tier Two words as well. Tiers One, Two, and Three vocabulary words are the responsibility of all teachers.

Science vocabulary is regularly found in dense textbook excerpts. The language found in text books is "technical, abstract, dense, and authoritative" (Freeman & Freeman, 2009, p. 72). As previously mentioned, science instruction does not include only content-specific words. A great metaphor is used to describe this idea. Think of science specific words (Tier Three) as bricks and general academic words (Tier Two) as mortar (Short et al., 2010). It is important that

students understand both categories of words to have the best understanding of science. Both Tier Two and Tier Three words are vital to build a strong foundation of "bricks and mortar" in the science content area.

In Science, many of the content-specific words are not found in other content areas. Furthermore, Tier Three words in science texts need to be defined in order to understand the meaning of the text. Skipping these words will cause the reader to lose the comprehension of the text (Short et al., 2010). In addition, the Tier Two words found within the science text (e.g. determine, explain, predict) will help add to the understanding of the Tier Three words and overall meaning. Many teachers do most of the talking in classrooms, and limit student responses. According to Short et al. (2010) "for our students to achieve academically in science, they need to have practice with language skills that allows them to back up claims with evidence, be more detailed in their observations, use persuasive language compellingly in arguments, and compare events or points of view" (p. 20). In order for students to practice their language skills teachers need to have frequent, daily practice of academic language in classroom discussions. If a student is able to use the language orally, it is more likely that they will use it in writing and understand the meaning in reading.

Math has been seen as a universal language in the past. Many teachers wonder why their English Language Learners (ELLs) struggle to grasp math when it is supposed to be accessible to all. The truth is that the complexities of the English language are seen in math and there are numerous Tier Two and Tier Three words that need to be explicitly taught. Echevarria, Vogt, and Short (2009) state "mathematics is more than just numbers; math education involves terminology and its associated concepts, oral or written instructions on how to complete problems, and the basic language used in a teacher's explanation of a process or concept" (p. 1). Today's math includes complex word problems. Conceptual understanding is "the comprehension of

mathematical concepts, operations, and relations" (Devlin, 2007, para. 8). Conceptual understanding is usually evidenced in writing a solution, describing reasoning, or explaining "why" rather than just providing an answer (Moschkovich, 2010). The Common Core State Standards (2010) in math expect students to communicate their reasoning through multiple representations, engage in productive pictorial symbolic, oral, and written group work with peers, explain and demonstrate their knowledge using emerging language, and extract meaning from written mathematical texts. Moschkovich (2010) suggests that because the conceptual understanding is so challenging for English Language Learners, teachers should focus on ELL students' mathematical reasoning, not the accuracy in using language. ELL's responses will likely be in imperfect language and often teachers will become sidetracked by the language errors. The goal should remain on engaging students in mathematical practices.

During math lessons Moschkovich (2010) advises teachers to draw on multiple resources offered in classrooms such as "objects, drawings, graphs, and gestures" (p. 18) to supplement instruction. This research shows that ELs, even as they are learning English, can participate in discussions where they grapple with important mathematical content. Instruction for this population should not emphasize low-level language skills over opportunities to actively communicate about mathematical ideas. One of the goals of mathematics instruction for ELs should be to support all students, regardless of their proficiency in English, in participating in discussions that focus on important mathematical concepts and reasoning, rather than on pronunciation, vocabulary, or low-level linguistic skills. By learning to recognize how ELs express their mathematical ideas as they are learning English, teachers can maintain a focus on mathematical reasoning as well as on language development.

One question still stands in the content areas and academic language discussion. How do teachers prepare to infuse good academic language practices into their content classes? Freking, Park, & Francois (2015) describe the teacher-educator program at UCLA. The program at UCLA decided to integrate secondary literacy methods into their content methods courses. The program also required its students to take a Language Acquisition course. This study of the program found that the teacher candidates were strong with content knowledge. Similarly, the content methods instructors "were skilled in their discipline specific pedagogy" (Freking et al., 2015, p. 62), however the instructors were not sure of how to add literacy practices into their course. Most of the professors did not have a foundation in literacy. The program trained the course instructors and redesigned their classes to include language instruction, skills, and theories. The two-year program's core belief about academic language is "that building on students' knowledge and experiences helps them to access content" (p. 61). The UCLA teacher-educator program believes that teachers need to be "fully immersed in the practice of integrating academic language into the cycle of planning, instruction, assessment, and reflection" (p. 62). To have effective content-area instruction at the secondary level, "academic language informs content pedagogy" (p.62). While learning skills and strategies for teaching academic language, the teachers also learned how to "create safe, rigorous learning environments for their students" (p. 64).

Academic language is an important part of content area instruction. Content teachers require that students use specialized vocabulary in essays, lab reports, and other classroom activities (e.g. discussing an issue, asking for clarification, and expressing disagreement (Freking et al., 2015, p. 67)). However, it is common that content areas teach only their Tier Three content-specific vocabulary words and expect that the students will know the Tier Two words

necessary for achieving mastery on the above tasks. It is important to remember that all teachers

are responsible for explicit instruction in both Tier Two and Tier Three Words.

English Language Learners and Academic Language

There have been few studies conducted on English Language Learners (ELLs) and

interventions intended to build vocabulary among students learning English as a second language

(Calderón, August, Slavin, Duran, Madden, & Cheung, 2005). The majority of the studies

address how ELLs acquire academic language. Researchers believe that academic language

acquisition is an important area of study because ELLs face the challenge of acquiring basic

knowledge in a second language and academic language that we require in today's schools.

Cummins (1999) published research about how ELLs acquire language. ELLs acquire

social language before they acquire academic language. The social language was coined by

Cummins as "basic interpersonal communication skills" (BICS). The academic language is

labeled as "cognitive academic language proficiency" (CALP). Academic language is a second

language for all students (Kinsella, 2006; Zwiers, 2008). ELLs acquire BICS before CALP.

Cummins found that ELLs could take five to seven years to acquire CALP. Although academic

language is a second language for all, developing it is still a barrier for ELLs. Academic

language is very complex because of the vocabulary and sentence structures (Barrow, 2014).

According to Yoder (2013) in 2011, "ELLs scored 36 points behind English-speaking students

on the National Assessment of Education Progress [NAEP] reading assessment at the 4th-grade

level" (p. 40). Research by Collier & Thomas (1989) showed that ELLs need seven to ten years

immersed in English language instruction before acquiring academic language. Both Cummins,

Collier and Thomas found that acquiring academic language takes a significant amount of time for ELLs.

August, Branum-Martin, Cardenas-Hagan, Francis, Powell, Moore, & Haynes (2014) focused on cultural and linguistic diversity in literacy learning. August et al. sought to assess the effectiveness of a Quality English and Science Teaching 2 (QuEST 2) intervention given to middle school English Language Learners (ELLs) and English proficient classmates to develop academic language in science, required by the Common Core State Standards. The authors performed this study to follow up on their own previous studies of the topic and also to supplement current research in the field of science instruction, as there are few experimental studies focusing on improving ELLs science outcomes

An overriding principle in the research study is that an intervention must be effective for ELLs as well as for their English proficient classmates because these groups are often grouped together in the same classrooms. The authors have found that the National Center for Education Statistics (2002) have reported that more than 41% of public school teachers have taught students with limited English proficiency (p. 55). There is a need for interventions that will help teachers use strategies to develop their ELLs and English proficient students academic language. The results of the study showed on the posttest that the treatment group (QuEST 2) had higher scores in vocabulary and science knowledge and shows that QuEST is an effective intervention.

Diane August is the author of additional research studies assisted by other professionals. A 2005 study by August, Carlo, Dressler, & Snow argues that ELLs who develop vocabulary slowly are less able to comprehend text at their grade level compared to their peers. August et al. found that ELLs often perform poorly on assessments because of their limited English vocabulary knowledge and are more likely to be diagnosed as learning disabled. The "specialized

vocabulary of academic content classes makes participation and comprehension difficult for ELLs" (Yoder, 2013, p. 39).

An article by Lorna Collier (2008) titled "The importance of Academic Language for English Language Learners" states that all ELLs have something in common: "they all have a need to learn academic language in order to succeed in school" (p. 10). Collier believes that children whose native language is English will pick up academic language relatively easily, and that it's much more difficult for ELLs. Academic language is even more difficult when someone comes to the United States in high school, with so much to catch up on in regards to language. Collier found research that shows learning academic language can take four to seven years. Some strategies Collier suggests for teachers are: using modeling and guided lessons; using cognates for academic terms, especially those that share Latin and Greek roots; using accessible texts to engage students; using the internet to find videos to illustrate lessons; doing hands-on project; and encouraging teachers to study conventional phrases in the languages most often spoken by their English language learners.

Yoder (2013) performed a study asking "how does structured academic discussion impact the academic language of U.S. history among seventh-grade ELLs?" (p. 42). The languages spoken by the students in the study included: Kurdish, Arabic, and Spanish. Structured academic discussion gives students opportunities to practice using academic language in the classroom. This type of discussion is "routine and predictable" which helps to put ELLs at ease (p. 48). Yoder found that structured academic discussion increases student learning and academic language development. Kinsella (2005) agrees that ELLs need structured opportunities to use new academic vocabulary every day. Dr. Kinsella notes looking at teachers' lesson plans and seeing that only the teachers would be talking. Dr. Kinsella then asks the teacher "at what

moment will you interrupt your instruction? If you're asking a question, how will you make sure

that everyone responds? What opportunities have you built in for students to actually use the

vocabulary?" (p. 2). Kinsella states that ELLs "will not develop an expressive academic

vocabulary just from listening to a discussion. They develop it by really being taught and by

being put in situations where they have to use the words" (p. 2). Another way that teachers can

constrain ELLs' vocabulary acquisition is by limiting the students' exposure to content concepts

by controlling materials. A modification teachers will often employ is cutting down the amount

of reading or giving a passage at a lower reading level. By doing this, the amount of information

ELLs learn over time is considerably less than their classmates who are reading the full grade

level texts. When the exposure is lessened for ELLs the "rich get richer and the poor get poorer"

(Echevarria et al., 2009). Instead of closing the gap between ELLs and native English-speaking

students, it widens.

       Kinsella (2005) offers many strategies for teaching academic vocabulary to ELLs. The

first strategy is to engage ELLs in fluent, wide reading. To expose students to more academic

vocabulary, Kinsella suggests that teachers use "short, engaging, issue-based nonfiction

readings" (p. 1). Teachers also need to give direct-scaffolded instruction of important words and

teach word knowledge, parts of speech, and word usage. Kinsella recommends a routine,

consistent instructional sequence for pre-teaching new words to students. Within the

instructional sequence teachers need to give the meaning of the word and check for

understanding of the word. In the sequence students should be given an opportunity to repeat and

say the word aloud. Kinsella stresses the importance of saying each syllable slowly so that when

the ELL reads the word they will have better chances of saying each syllable. In addition

vocabulary instruction should include: show the word, pronounce the word, clarify the part of

speech, give synonyms and explanations, provide a visual, rephrase the explanation, and assess the students comprehension of the word (p. 3).

The Kawana School in California student population is 72% English learners and develops academic vocabulary in math by using Thinking Maps (Kinsella, 2005). The Thinking Map strategy "helps student organize and graphically display their thoughts" (p. 4). For example, in a first-grade mathematics lesson focusing on "classifying familiar plane and solid objects by attributes and explain which attributes are being used for classification" (p. 4), the teachers begin the unit by introducing the students to two-dimensional shapes. After students are able to identify and define shapes, they are asked to compare the similarities and differences between the shapes. The students create a Double-Bubble Map to make a comparison between two shapes. When the students are taught three-dimensional shapes, the teacher engages the students in a variety of activities such as creating a shape "recipe" and building three-dimensional shapes with nets. The teachers show the students a net made from paper and ask the students to predict what shape it will form. The students refer to Thinking Maps around the room using the vocabulary words and pictures to respond to the teacher's question.

Cognates can be a tool for building academic language for Spanish speaking students (Freeman & Freeman, 2009, Kinsella, 2005, Beck et al., 2002). Cognates are Spanish words that have a "similar meaning, spelling, and pronunciation" as English words (Kinsella, 2005, p. 5). According to Kinsella, "teaching students about English/Spanish cognates can significantly increase the number of words in their vocabulary and provide skills that help them infer meaning in newly encountered words" (p. 5). When teaching students about cognates it is recommended that teachers: 1. State the English word and the Spanish cognate, 2. Have the students say the word in both English and Spanish, 3. Have students look at the word and discuss how they are

alike and how they are different, and 4. Verify the meaning of the word in English and Spanish

(p. 5). A word of warning about cognates is that there are false cognates that have similar

spelling and pronunciation, but have a different meaning. It is important to note false cognates

when teaching ELLs. See Appendix B for a list of common cognates.

Barrow (2014) gives strategies for teachers to use when teaching math to ELLs. Barrow

notes that these strategies are valuable for all students and should be used on a regular basis. First

is talking. ELLs need to practice the language by speaking, and teachers should be giving

opportunities for students to use the words in discussion. The second strategy is called chunking.

For example, "instead of teaching 'inch' in isolation, also teach foot, centimeter, and yard. This

helps students develop their schema and mentally organize their new vocabulary" (Borrow,

2014, p. 38). Another strategy is to get the students moving by using movements and gestures.

The movement helps students associate the meaning of a word to a certain gesture. Finally,

journaling can be used as a strategy. A math journal can be used to keep definitions,

nonlinguistic representations of words, and analogies. The emphasis of Barrow's work is that

ELLs can often be mistaken for having low cognitive abilities and therefore are classified for

special education services. Barrow's aim is that if teachers can use the above strategies they may

be able to limit gaps in vocabulary acquisition and give all students a greater depth of vocabulary

knowledge.

Research by Lucero (2014) followed three first grade dual language classrooms whose

instruction was 50% English and 50% Spanish. Lucero found that all three teachers offered oral

linguistic scaffolding for emergent bilingual students at the micro and macro levels. Lucero saw

that linguistic scaffolding could be a form of academic language instruction. At the micro level,

the teachers repeated key terms, restated or rephrased, and the students had language

responsibilities. At a macro level, Lucero analyzed and observed entire units of study. Lucero found that teachers and students built knowledge together, and the teachers asked the students to produce more language in their zone of proximal development. An implication from this study is that academic language instruction "should happen at both the individual child and whole class levels" (p. 555).

When assessing academic language, Kinsella (2005) encourages teachers to create more generative assessments. "Unlike short-answer or multiple-choice assessments, generative assessments require profound understanding of the word and its creative application" (p. 7). An example of a generative assessment is to ask students to complete the sentences on the board with the appropriate word, and then discuss the sentences with a partner to see if they make sense. Instead of memorizing sentences or definitions, the students are required to use critical thinking to fill in the templates. The students really have to think about the words and how they can be used in different sentences and contexts.

Teachers with renowned accomplishment with ELLs share certain characteristics: a) "a high commitment to students' academic success and to student-home communication, b) high expectations for all students, c) the autonomy to change curriculum and instruction to meet the specific needs of students, and d) a rejection of models of their students as intellectually disadvantaged" (Moschkovich, 2010, p. 18). Another critical belief is that "providing the necessary academic language foundation for underprepared students is the work of all teachers— at all grade levels and in all subjects. It is a shared responsibility that, when worked at consistently and collaboratively, is certain to help narrow the language divide among our students" (Kinsella, 2005, p. 5).

ELLs deserve the spotlight when it comes to 21st century education. Discussing the needs of ELLs is necessary because of the growing numbers in our schools today. There are different strategies teachers can use in their classroom to help ELLs acquire and develop academic language. It is extremely likely that any educator reading this will have had experience teaching ELLs or will teach ELLs in the future. Beginning with No Child Left Behind and now with the CCSS, it is expected that teachers help develop the academic language of their students. It is imperative that teachers remember that "new English learners can quickly learn the language for social situations; learning English for academic purposes is a more complex challenge. Teachers can help by employing thoughtful strategies" (Barrow, 2014, p. 35).

Strategies

Strategies Pre-Kindergarten-Sixth Grade. Academic language instruction at the elementary level must be explicit and carefully orchestrated. No longer are the days of telling children to look up words in the dictionary and unplanned spontaneous vocabulary teaching. Vocabulary instruction should include direct teaching of important words and fostering "word consciousness" (Feldman & Kinsella, 2005). The following instructional routine is an effective way to teach new academic vocabulary words at the elementary level. First, teachers should remember to give the students an opportunity to pronounce the words. Saying the word out loud two or three times gives students the opportunity to commit the word to auditory and muscle memory (Feldman & Kinsella, 2005). Words that are long or unusual can be divided into each of its syllables. Next, the teacher should explain the term in familiar language. A synonym can be given to supplement the meaning and possibly link a student's prior knowledge to the new term. Examples are given next and should come from a variety of contexts. The context of the word

from the lesson will be the first explained and then the teacher should delve into other possible

contexts of the word. Following the context, should be opportunity for students to elaborate on

the new words. The elaboration can be students "generating their own additional examples and

visual representations" (p. 6). Finally, it is important that teachers assess the vocabulary.

Formative, swift assessment can be used at the end of the lesson as well as summative

evaluations such as tests and quizzes. Instead of having students demonstrate their knowledge by

memorizing definitions and matching words to definitions, assessment should require deeper

thinking and understanding (Feldman & Kinsella, 2005). Two ways that teachers can allow

students to demonstrate deeper understanding is by using "focused questions and generative

tasks like developing additional examples" (p. 6).

Since it takes numerous encounters with a word for a student to learn it, students need to

work with a word in a variety of ways each week. To develop expressive vocabulary, students

should be using the words by speaking and writing. To cultivate receptive vocabulary, students

need to be listening to and reading the words (Feldman & Kinsella, 2005). A great way for

students to take vocabulary notes is by providing an advance organizer that already has the most

important lesson terms typed up. There are blanks for the children to fill in during the lesson, and

gives the students a reference tool to look back at and study. A sample note-taking guide can be

found in Appendix C.

Since all students are academic English learners, they need to hear academic language

modeled out loud. One way teachers can model academic language is through a think aloud.

Think alouds are when a teacher stops instruction to model their thinking out loud to the

students. Along with think alouds, teachers should give hand motions, gestures, and facial

expressions that correspond with words and phrases (Zwiers, 2014). The movements should be

attached to basic academic language devises. When a word is taught with a movement, both can be recorded to a chart in the classroom for students to refer to. Students should be encouraged to use these words and movements during discussion and also incorporate the words into their writing. Zwiers' academic language actions can be found in Appendix D.

      During classroom discussions, teachers can repeat student responses for emphasis. When a teacher repeats a response it can emphasize or highlight key words or phrases and gives students a second chance to hear and understand the word. In addition, teachers can rephrase student responses to upgrade the language being used to academic language. By "rephrasing with more developed clauses and sentences, students can hear their own words being used in new academic frames. This is a form of modeling" (Zwiers, 2014, p. 67). Teachers rephrase chosen responses to clarify them, make them more explicit, and direct the response into what they believe the purpose of the text might be (Zwiers, 2014).

      Students of all ages benefit from participating in classroom discussion but in each classroom there are students who do not participate for many reasons. A way that teachers can engage all students in discussions is by using small groups and pairs. "These smaller-scale discussions, when properly supported, can be very effective for building thinking, language, and content understanding in all students" (Zwiers, 2014, p. 151). In small groups, not only do students have a chance to talk and share ideas, but they also get to listen to other students' responses. In addition, it is powerful for students to hear responses to their ideas and questions. Because students are independent from a teacher, they are likely to feel safer and feel less stressed to practice their language. The CCSS also require that students interact in groups. One example from the standards is that students need to "engage effectively in a range of one-on-one

and group discussions, build on others' ideas, and express their own ideas clearly" (NGA Center & CCSSO, 2010a, p. 33).

When students share with a partner it is often called a "think-pair-share" (TPS). TPS's build language and knowledge and should be used frequently throughout the day. Zwiers (2014) recommends that students think in silence for thirty to sixty seconds to prepare what they are going to say. Students will then share with a partner from one to five minutes. During this time teachers remind students to use language from the charts or posters on the walls around the room. If students are having trouble starting they can use sentence starters. One variation of a TPS is a "double-prompt-pair-share" (p. 175) which is where a teacher creates two different questions—one for each student. Teachers can use this if they have students who frequently respond to TPS's with "ditto" or "I agree". Another variation of a TPS is a "think-pair-square". A "think-pair-square" has each pair of students turn to another pair of students and share and then create a synthesis of the two pairs (Zwiers, 2014). This variation of TPS is great because students do not have to share with the whole class and synthesis is an important skill to work on.

Academic conversations need modeling and scaffolding to allow students to become stronger in their discussions. Zwiers (2014) suggests that teachers take an informal conversation and turn it into a formal academic one. The teacher would choose an informal dialogue from their discipline and model how they would change the first half into more academic language. The upgraded language can be called "academify". After the first half is modeled, pairs of students will try to "academify" the second half of the dialogue. When they are finished the pairs of students share how they changed it and justify their revisions. Another way to have students practice more academic discussion is to provide students with discussion starters. The sentence starters can be posted in the room or printed on individual cards for each student to use.

There are strategies teachers can show students to help them practice and study their academic vocabulary. One strategy is called "Read, Cover, Recite, Check" where students read the word, cover it up, give the definition and examples, and check to see if they are correct (Feldman & Kinsella, 2005). Vocabulary study cards are made on 3" x 5" cards that contain the "definition, synonyms, examples, non-examples, associated images, and sentences" (p. 8). The students can use the cards independently or with a partner. Another study strategy is to use vocabulary notebooks in the classroom. Students keep a record of words taught in class as well as personal choice words they may come across while reading. The notebook should have a routine way of presenting information, like the index cards.

Strategies 7-12. Strategies that support academic language acquisition at the middle and high school are similar to those in the elementary school. The difference is that vocabulary work should lead to deeper investigations of language. The students should be thinking about "how language gives meaning and how words mean what they mean" (Beck et al., 2002, p. 85). To start off, it is important for students to have multiple encounters with the academic vocabulary words before they can become a permanent part of a student's comprehension (Beck et al., 2002). Also important is that instruction should be rich and go beyond dictionary definitions of the words. Included in the rich instruction should be extension of the words—how is the word used outside of the classroom? What is the context? Are there multiple meanings? High school students need to regularly use the academic language in order for it to become natural and fluid.

Elements of middle-school vocabulary instruction should include the students recording the words in a notebook or journal with the definition and examples. Next, students should engage in a discussion of the words and how they relate to the story or readings. The students

should find relationships between words and how they would explain the relationship. Students

should use the words. Teachers can group students and have them practice creating sentences

using the vocabulary words and sharing them with the class. An extension to the above activities

would be to assign the students to watch the news and see how many of the vocabulary words

they can hear during the news reports (Beck et al., 2002).

A five-day cycle approach (Beck et al., 2002) begins with introducing the words with

pictures. The meanings are given and words are added to a log sheet. Throughout days two-four

the students perform a sentence completion activity (ex: *binoculars*, The bird singing up in the

tree is too far away for me to see so_____) (p. 80). Another activity is choosing

between pairs of target words (ex: Which would you do if you had trouble seeing clearly? *focus*

or gape?) (p. 80). The students are asked to complete a closed sentence activity with the

vocabulary words and an alike/differences activity. In the alike/different activity, the students

would be given a description like "they're both things you do with your eyes that change the way

your face looks. One makes you open your eyes wider than normal, the other makes you close

them partly" (gape and squint) (p. 83). Finally, the students would complete a timed activity

called "Ready, Set, Go." This fast-paced partner activity is the final activity preparing students

for the next day's assessment. Day five is a multiple-choice assessment. Notice that this five-day

cycle does not teach synonyms. Teaching synonyms is a popular and quick way to present

vocabulary however with the task of preparing for standardized tests, students need to hear word

definitions so that they can compare meanings between words (Beck et al., 2002). Synonyms can

be used, but not in isolation.

There are strategies specific to history. The language of history "is used primarily to

describe the past, its interpretations, and its relevance to the present and future" (Zwiers, 2014, p.

89). The CCSS require students to develop deeper thinking about history, yet most history

textbooks do not move beyond facts, dates, events and important people. CCSS RH 9-10.3

require that students "analyze in detail a series of events described in a text; determine whether

earlier events caused later ones or simply preceded them" (NGA Center & CCSSO, 2010a, p.

48). In order for teachers to guide students into deeper thinking about cause and effect, educators

can point out cause-and-effect verbs within a text signaling key understandings. Students also

need to be taught to make mental connections while they are reading historical texts. Teachers

can model this to students. In order for students to make connections, they need to have the

background knowledge about the ways humans influence events or vice versa (e.g. fear, racism,

religion, compassion, desire for wealth, power, fame, freedom, truth, and natural events) (Zwiers,

2014).

Perspective taking is an important way that students can learn history. When students

take on a different perspective it promotes in-depth learning. It is difficult to take on different

perspectives because we must "fight our tendencies to perceive life as we have experienced it"

(Zwiers, 2014, p. 94). History teachers can give or post academic expressions for perspective

taking in History. Some examples from Zwiers (2014) include:

- If I had been…, I would have…because…

- One way to interpret this event is…

- For us in modern times, it could mean that…

- From his perspective, I think he was thinking…(p. 94)

In math, teachers often model mathematical processes without using the academic terms to

explain their processes. At some point, (which could be in college) students without previous

instruction in mathematical terms will feel overwhelmed with a math teacher's terminology. In

addition, the CCSS require students to justify and support their conclusions (NGA Center & CCSSO, 2010a). When students explain their work it requires academic language. Essentially, to develop the academic language of math, teachers need to explain terms and model using the terms regularly. Students should be given the opportunity to practice using the terms orally and in writing as well.

In science language tends to be technical and specific. Like math, science has specific terms that should be taught as well as specific charts and graphs. In science there is the added demand of lab reports. Typically speaking, teachers tend to define scientific inquiry words such as hypothesis and validity, but they do not provide examples. Providing examples gives students concrete learning about each of the terms and provides a model for how they might conduct their own experiment. Examples may come from published reports, textbooks, newspapers, and the internet (Zwiers, 2014). For each step of the scientific process teachers can give and post specific language to use at each step. Appendix E shows language to use for each step of a science practice.

Assessment of academic language is an important component of language instruction. Beck et al. argue that a student can give a synonym for a word, but not know how to use it. Students can match a word to a definition but not be able to use it in a different context. Multiple-choice tests are only as good as their answer choices. When the incorrect choices are very different from the answer students may be able to get the answer correct without a deep understanding of the word. If the incorrect choices (often called distractors) are similar in meaning it will take a lot of thinking for at student to select the correct choice, but also demonstrate to the teacher that they understand the true meaning of the word. Other ways to assess students' word knowledge is to ask students what the words mean, have the students create examples, distinguish between an

example and nonexample, describe what is alike and/or different for pairs of words, and ask

students to place word phrases on a word line that represents a continuum, and explain their

placement (Beck et al., 2002, p. 97).

Example of a word line continuum (vocabulary words in italics):

How happy would you be…
1. After *trudging* home through the rain?
2. If the president *commended* you for being brave?
3. If your mother *urged* you to have a second piece of cake?
4. If you thought someone was *stalking* you?
5. If a herd of sheep *meandered* into your living room?
6. If everyone in your class looked *glum*?
Least Happy --Most Happy
                                                                    (Beck et al., 2002, p. 98)

Conclusion

Academic language is the language required to learn effectively in schools and academic

programs. Academic language has not been taught effectively in the past—with many educators

not realizing that academic language needs to be explicitly taught. The CCSS have brought

academic language into the spotlight and deemed it's acquisition an important skill for college

and career readiness. Academic language is pivotal for all subject areas and grade levels. All

students are academic language learners, however our English Language Learners need even

more planned and intensive instruction.

Common Core State Standards Justify the Use of Academic Language

The writers of the CCSS justified the use of academic language in college and career

preparedness by stating that only half of students who took the 2004-2005 and 2008-2009 ACT

test met the benchmark score, demonstrating that there was a gap between high school and

college level text complexity. The authors of the CCSS also explained the importance of students acquiring a rich and varied vocabulary, and introduced the three tiers model to classifying academic language. The writers found that teachers are not teaching Tier Two language as strongly as Tier Three language. When students miss out on Tier Two language instruction, it is significantly more difficult for students access grade-level texts, understand the context, and understand Tier Three vocabulary.

Academic Language in the Content Areas

Through my research I found that academic language needs to be taught explicitly in the grade levels with time for students to practice using the language. Furthermore, teachers need to clearly teach both Tier Two and Tier Three vocabulary and model how they are used. In addition, research shows that content area texts (mainly textbooks) are dense and complex for math, science, and social studies. I found that math is not a universal language and reading is highly incorporated into math word problems in the Common Core State Assessments. With the bulk of math no longer being equations, math teachers share equal responsibility for teaching academic language. The teacher-educator program at UCLA has implemented an academic language course, and incorporated academic language and literacy into their secondary content area classes. UCLA values academic language and seeks to prepare its students for today's teaching demands. Hopefully many other schools will follow suit.

Academic Language and English Language Learners

Research shows that ELLs develop social language before academic language. This means that ELLs will sound language proficient in casual conversations, but will not be academic language proficient for upwards of 7 years. There are few studies that have looked at ELLs and academic language development, but the few that have found that ELLs need explicit instruction, modeling, and frequent opportunities to practice using the language. ELLs also

benefit from closed notes and sentence starters. When teachers know these needs, ELLs can reach academic language proficiency more quickly, hopefully in time for college and career entrance.

What all of the data means to me is that there is a significant need for teachers to be aware of academic language acquisition and to plan it into each day's lesson plans. Teachers may see "academic language terms" in the beginning of their curriculum's units of study but educators need more assistance than printing Tier Three words into teacher manuals. Schools need professional development sessions about teaching academic language, and teacher-preparation programs need courses on academic language acquisition or imbed them into content courses. It is every teacher's job to teach academic language pre-kindergarten through twelfth grade.

Implications

Implications for practice include the strategies found in the "strategies" section of this paper. This paper could not include every strategy there is for academic language acquisition but it is a good starting place. Teachers need to be aware of their specific students' needs and realize that the needs of their students might change from year to year. With the basic strategies outlined above, teachers can make large gains in the academic language instruction of their students. Think about if a student begins explicit academic language instruction in Kindergarten and each year after, how proficient they would be by middle school. With increased opportunities to practice using the language of school, students could be prepared for rigorous high school Advance Placement class discussions, and therefore more prepared for college discussion. Once students begin a foundation, the process of adding on to, and using academic language becomes easier.

Limitations

The study had a time constraint of five months, it only included the interpretation of one person, and was limited to ~50 pages. This study is missing the special education population of students and data. This study is also missing information about how to teach academic language in Social Studies. The current study had a broad criteria for its research sources. The five month time constraint was due to the nature of the capstone class and the College at Brockport's semester length. The study only included the research and interpretation of one person because this project is designed to be an individual demonstration of learning at the culmination of the end of our Master's program. The 50 page maximum was a requirement sanctioned by the Department of Education and Human Development. Potential weaknesses of this study include the fact that it is only findings from very recent studies. There is a possibility in the coming years that more comprehensive studies will be published with new implications.

Future Research

Future research needs to include studies addressing the academic language acquisition of students with disabilities. Future research should also include a higher concentration of research studies in place of literature in this systematic review. Research could also include research studies focused on elementary-aged children.

The current study is valuable to the education field because it provides the background for academic language, discusses how academic language is taught in the content areas, how ELLs are impacted, and strategies and best practices for instruction pre-kindergarten through twelfth grade. Research was very current and proves that this project came at a crucial point in education reform. The significance of this study is a deeper understanding of what academic

language is, how it's taught, used, and assessed. Academic language is needed in every

classroom for every child.

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Appendices

Appendix A
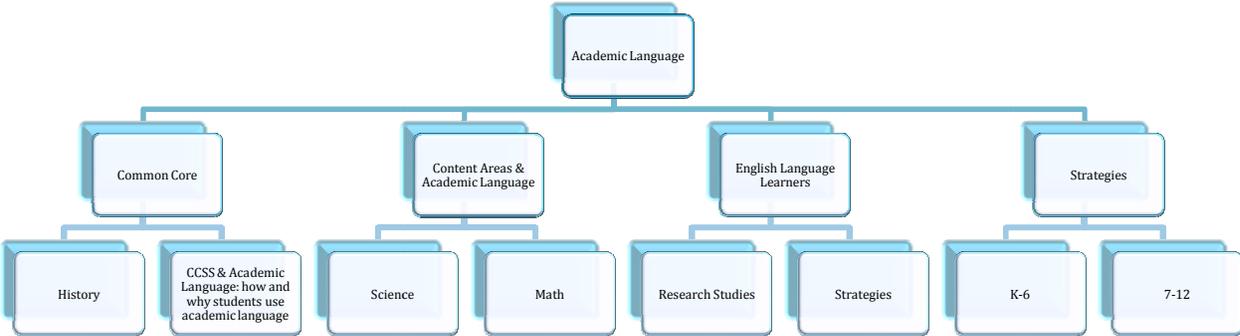
Appendix B

Recognizing Cognates: Nouns

English nouns ending in –or or –al are very often identical in Spanish.	Ex: actor/ actor, capital/ capital
Many English nouns ending with –ist can be converted to Spanish by adding –a.	Ex: artist/ artista, dentist/ dentista
Very often, -ism ending can be replaced with -ismo to translate words into Spanish.	Ex: idealism/ idealismo, tourism/ tourismo
Very often, -ance and –ence endings can be replaced with –ancia or –encia.	Ex: distance/ distancia, intelligence/ inteligencia
Very often, -ty endings can be replaced with –dad to translate words into Spanish.	Ex: electricity/ electricidad, variety/ variedad

(Kinsella, 2005, p. 5)

Appendix C

Sample Vocabulary Note-Taking Guide

Word	Synonym/Definition	Example/Image/Showing Sentence
Accurate, adj.	True, _____, exact, precise.	Rumors are often not _____ information. Image of a tabloid headline, "Elvis is alive!"
Reliable, adj.	Dependable, someone you can _____ on.	Our newspaper is always delivered by 6:00A.M.; our carrier Luis is very _____. Image of a newspaper on the front porch.

(Feldman & Kinsella, 2005, p. 7)

Appendix D

Language	Action or Expression
For this reason, because of this, thus, hence, therefore	Hands make forward pushing motion.
And, furthermore, moreover, in addition	Hands make a rolling motion forward.
In conclusion, in essence	Both hands start with fingers spread, then close to make a ball.
For example, for instance, to illustrate, let's say	Put index finger at the tip of little finger on other hand.
On the other hand, nevertheless, on the contrary, then again, even though, despite, granted, of course, however, but, yet	Move hand, palm down in one direction and then make a 180-degree arc to palm up; walk one way and turn around; look at the hand that is out and then put out the other and look at it.
Similarly, likewise, in the same way	Put both hands up with crossed fingers.

(Zwiers, 2014, p. 56)

Appendix E

Language Used to Describe Different Steps of Scientific Inquiry

Science Practices	Language for This Step
Ask questions about observation and phenomena (e.g., why is it happening, how)	-I wonder why… -Where does the…come from? -What kind of reaction could cause that? -What if we…?
Generate hypotheses that attempt to answer the questions.	-If we add…, then maybe… -I hypothesize that…because… -I think that it will because… -What do you think will happen? -Based on…, I think that… -Most likely, it will…
Carefully plan and design ways to test hypotheses. Figure out how to isolate variables.	-If we isolate the variable…, then we can see… -Several variables come into play… -We also need a control group. -We need a microscope to see how… -We need to change the…to see how… reacts. -How can we prove that…? -But what about the effects of…?
Use models to represent or describe scientific processes and relationships, collect data (e.g., lab), and predict.	-The control group doesn't get treatment. -The data should go into a table because… -We need to measure the…As the…increases, the…decreases. -There is a correlation between…and…
Make conclusions about the validity of experimental data and their support of the hypothesis. Make generalizations based on observations.	-The data show that… -We discovered that… -Our data were not valid or reliable enough to make solid conclusions about… -We found a negative correlation between… -Based on these numbers, it is likely that… -Our research has demonstrated that…

(Accessed from Zwiers, 2014, p. 97)