

Spring 5-1-2015

# Self-talk+ and Strategic Teacher Moves Aimed at Cognitive Advancement in Linguistically Diverse Elementary Mathematics Classrooms

Bailey M. Muchin

*University of Connecticut - Storrs*, bailey.muchin@uconn.edu

Follow this and additional works at: [https://opencommons.uconn.edu/srhonors\\_theses](https://opencommons.uconn.edu/srhonors_theses)

 Part of the [Bilingual, Multilingual, and Multicultural Education Commons](#), [Curriculum and Instruction Commons](#), and the [Educational Methods Commons](#)

---

## Recommended Citation

Muchin, Bailey M., "Self-talk+ and Strategic Teacher Moves Aimed at Cognitive Advancement in Linguistically Diverse Elementary Mathematics Classrooms" (2015). *Honors Scholar Theses*. 456.  
[https://opencommons.uconn.edu/srhonors\\_theses/456](https://opencommons.uconn.edu/srhonors_theses/456)

Self-talk+ and Strategic Teacher Moves Aimed at Cognitive Advancement in Linguistically  
Diverse Elementary Mathematics Classrooms

Honors Thesis

University of Connecticut

2015

Bailey Muchin

## Table of Contents

Acknowledgements	p. 3
Abstract	p. 4
Chapter 1: Introduction	p. 5
Chapter 2: Review of Literature	p. 7
Chapter 3: Methodology	p. 24
Chapter 4: Results and Discussion	p. 33
Chapter 5: Implications	p. 56
Chapter 6: Conclusions	p. 58
Reference List	p. 61

### **Acknowledgements**

Thank you to the schools and teachers who willingly participated in this study and had their lessons recorded for analysis. I would specifically like to thank Mary Truxaw, my thesis advisor; this entire project would not have been possible without her guidance, expertise, and encouragement over the past year and a half. Lastly, I would like to thank my parents, sister, and brother for their continuous support and inspiration throughout my undergraduate career.

### Abstract

This study's objective was to determine the purposes of self-talk and related forms of talk (self-talk+) in linguistically diverse elementary mathematics classrooms, teacher moves that are often associated with self-talk+, and the relationship between self-talk+ and strategic teacher moves. This study analyzed transcripts, audio recordings, and video recordings from several elementary mathematics classrooms in dual language programs in order to determine the relationship among self-talk+ and strategic teacher moves. This study specifically focused on the purposes of self-talk+ that contributed to, or had the potential to impact, student cognitive advancement. The results of data analysis were mapped in order to visualize the relationships among self-talk+, strategic teacher moves, and cognitive advancement. The results associated with each research question were grouped by topic: purposes of self-talk+, teacher moves related to self-talk+, and relationship among self-talk+ and strategic teacher moves. The purposes of self-talk+ identified and aligned with the literature were found to include: ruminate on a difficult matter, increase understanding of a novel concept, redirect/restructure thought process, focus on technical aspects of a skill, effectively engage with a task, and increase understanding of a novel concept. Teacher moves used in conjunction with self-talk+ were found to include: wait time, modeling, and prompting. Finally, it was found that when self-talk+ and these strategic teacher moves were used together, students were more likely to make significant cognitive advancements.

*Keywords: self-talk+, strategic teacher moves, cognitive advancement, modeling, prompting, wait time, metacognition*

Self-talk+ and Strategic Teacher Moves Aimed at Cognitive Advancement in Linguistically  
Diverse Elementary Mathematics Classrooms

**Chapter 1: Introduction**

With the implementation of Common Core State Standards starting in 2010, American students are now being pushed to make significant cognitive advancements, deepen their comprehension of material, and meaningfully reflect upon the material they are learning (Council of Chief State School Officers [CCSSO] & National Governors Association Center for Best Practices [NGA Center], 2010). The Common Core State Standards (CCSS) are a set of uniform guidelines that encourage students to begin “developing the critical-thinking, problem solving, and analytical skills” which they “will need to be successful” (CCSSO, 2010, para. 2). While valuable, these goals may not be readily achievable for every student within the American school system, particularly for the growing population of English language learners (ELLs) (CCSSO, 2012; National Clearinghouse for English Language Acquisition, 2011). ELLs face a more complex challenge than other students because they must gain a substantial comprehension of the English language to participate in the academic setting in addition to acquiring the skills and knowledge delineated by the CCSS (CCSSO, 2012).

In order to reach the CCSS objectives, it is necessary to consider innovative ways of helping students advance cognitively, develop their understanding of material, and self-regulate their comprehension. Self-talk (i.e., talking aloud to oneself about one’s own ideas prior to sharing out) could be used as an innovative instructional strategy to fulfill many of these functions. Many studies have looked at the uses and functions of self-talk in a variety of settings (Callicott & Park, 2003; Kolovelonis, Goudas, & Dermitzaki, 2012; Manning, 1990), but very few have considered the use of self-talk as method of reaching the educational intentions of

CCSS, especially with ELLs and bilingual students. In striving to find novel techniques to reach the CCSS objectives, a reasonable next step would be to evaluate the potential benefits and productive outcomes of using self-talk as an instructional strategy.

This study investigated the purposes and use of self-talk+ (i.e., self-talk and related forms), independently and in conjunction with teachers' strategic moves, in dual language elementary mathematics classrooms. Dual language classrooms (i.e., classrooms where students are taught in two languages) were of particular interest because, although there are benefits of speaking more than one language, there is evidence that there are disparities between mathematics achievement of English language learners and other students. This study specifically focused on the purposes of *self-talk+* that contributed to, or had the potential to impact, student cognitive advancement. This study analyzed various forms of classroom data—video recordings, audio recordings, and transcripts—in order to determine the relationships among self-talk+, talk moves, and student cognitive advancement. The data were analyzed using grounded theory and constant comparative methods in order to continuously analyze, determine key themes, test hypotheses, identify essential moments of connection, and develop theories (Strauss & Corbin, 1990). After reviewing video recordings and transcripts of multiple classrooms, two specific classrooms were identified for particular focus. Video and transcription data from these focus classrooms were analyzed and coded in order to identify interactions that displayed purposes of self-talk+, use with strategic teacher moves, and potential for student cognitive advancement. As will be described, the research found various purposes of self-talk+ that could contribute to student cognitive advancement, strategic talk moves that were used to assist student's cognitive advancement, and some instances when which self-talk+ and strategic talk moves were combined to advance students cognitively.

## **Chapter 2: Review of Literature**

In this literature review, I will first define the terms for methods of communication that I will be using throughout the paper. I will then describe theory used to frame the ideas of self-talk—specifically, theories that stemmed from Vygotsky’s investigation of thought and language. The theoretical framework will include developmental progression, function, and purpose of these types of speech. I will present the reflections of Vygotsky’s work within the literature I have researched. I will then discuss a related form of talk similar to self-talk, exploratory talk, and what the literature reveals about its purposes. Additionally, I will discuss teacher moves and talk formats used in mathematics classrooms to promote reasoning and cognitive advancement. Furthermore, I will investigate the disparity between the performance of ELLs in the classroom and the cognitive advantages provided by speaking two languages. In conclusion, I will connect my areas of interest and present why self-talk may be used as a strategy in dual language classrooms or for ELLs in particular. Finally, I will present my research questions.

### **Egocentric Speech, Private Speech, and Self-talk**

Egocentric speech, which Vygotsky (2002) used synonymously with private speech, is defined as “speech for oneself, intimately and usefully connected with the child’s thinking” (p. 228). This relates directly to Theodorakis, Weinber, Natsis, Douma, and Kazakas’s (2000) definition of self-talk: “what people say to themselves either out loud or as a small voice inside their head” (p. 254). In both of these definitions, the researchers emphasize the use of private speech and self-talk as pertinent to the individual who is using it, embedded in the inner workings of the user’s brain, and employing a vocalization technique. Because of the consistencies across the definitions, the terms egocentric speech, private speech, and self-talk will be used synonymously throughout this paper.

## **Theoretical Framework: Vygotsky**

**Theories of thought and language.** Vygotsky recognizes that communication contributes extensively to the teaching and learning process (Truxaw, 2014; Vygotsky, 1978). In classrooms, this process is enhanced when a student advances through his or her zones of proximal development (ZPD), “the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers” (Vygotsky, 1978, p. 86). Methods of communication such as self-talk, egocentric speech, private speech, and exploratory talk, which will be described later, have the potential to positively assist a student’s advancement through his or her ZPD, especially when used in conjunction with strategic interactions with others.

**Developmental considerations from a Vygotskian perspective.** Vygotsky’s (2002) theories relating thought and language provide a framework for investigating self-talk and related forms of talk. Vygotsky (2002) extensively researched private speech (i.e. egocentric speech or self-talk that is vocalized) and inner speech (i.e. private speech that is not vocalized, but internal)—considering them independently—and also how private speech typically transitions into inner speech. Vygotsky (2002) claimed that private speech and inner speech are truly compatible in nature and considered them to be the same, apart from the vocalization component. Similar features that unite these types of speech are that the individual is engaging in these types of speech for his or her own self and that the speech need not be understood by anyone other than the speaker (Vygotsky, 2002). Vygotsky proposed essential similarities between private/egocentric speech and inner speech, “Both fulfill intellectual functions; their structures are similar; egocentric speech disappears at school age, when inner speech begins to develop” (p.

226). According to Vygotsky, this transition from private speech to inner speech occurs because the child is moving from social speech, the first learned method of communication (e.g., speaking to a parent out loud); to independent speech, in which the child is forced to think deeply, leading to conversations with himself out loud; and finally to necessary inner speech, a more developmentally appropriate behavior. Vygotsky provided reasoning for the transition of speech from social to egocentric to inner, proposing that this process is in alignment with the four stages of development for “all other mental operations” (p. 86).

Vygotsky’s four stages of language development indicate and provide insight into how and why children progress naturally from private speech to inner speech. The first stage is called primitive or natural stage and is characteristic of “preintellectual speech and preverbal thought” when the child merely engages in his or her own simple discourse, seemingly similar to babbling (Vygotsky, 2002, pp. 86-87). The following stage, deemed “naïve psychology,” occurs when children have experienced the physical world around them. This stage predates the child’s speech development and is “manifested by the correct use of grammatical forms and structures before the child has understood the logical operations for which they stand” (Vygotsky, p. 87). Due to the accumulation of experience the child receives, he or she moves onto the next stage, which is differentiated by “external operations that are used as aids in the solution of internal problems” (Vygotsky, p. 87). This stage is when egocentric speech becomes most prominent as the child thinks aloud in order to remedy problems he or she is experiencing. Finally, the child transitions into the “ingrowth stage” at which “external operation turns inward and undergoes a profound change in the process” (Vygotsky, p. 87). In terms of speech, this stage is when inner speech begins to be more prominent and children rely less on external communications. However, egocentric speech and inner speech are not completely separate, but steadily interact with one

another since they are highly intertwined (Vygotsky 2002). While self-talk traditionally transitions into inner speech, Vygotsky highlights some of the functions of talking aloud to oneself.

**Functions of private speech from a Vygotskian perspective.** Vygotsky (2002) did extensive research on the use of egocentric speech (private speech), the common characteristics of egocentric speech, its developmental transition into inner speech, and the function it provides for users. Children's use of egocentric speech arises once they are placed in situations, such as preschool, where they are required to think for themselves regardless of the conversations around them. Vygotsky claimed "egocentric speech, springing from the lack of differentiation of speech for oneself from speech for others, disappears when the feeling of being understood, essential for social speech is absent" (Vygotsky, p. 233). Once a child has become acclimated to the presence of their peers, his or her tendency to speak aloud to his or her self internalizes; the child is no longer relying on his or herself to provide cognitive stimulation in the form of conversation (Vygotsky, 2002). Vygotsky (2002) went on to conclude that private speech "becomes gradually intellectualized and starts serving as a mediator in purposive activity and in planning complex actions" (p. 39). As a result, private speech is a valuable component of the child's development of language and can be observed while students are performing activities and practicing their skills (Vygotsky, 2002).

Vygotsky and his fellow researchers attempted to determine situations in which egocentric speech arose more frequently. They performed an experiment in which they had the children perform more simple activities, such as drawing, addition, writing, etc., but added a series of "frustrations and difficulties" (Vygotsky, p. 29). For example, when a child was supposed to draw, the experimenter would have hidden the pencils, paper, or colors that he or

she needed. These were included in order to incite egocentric speech and determine its functions (Vygotsky, 2002). After performing these experiments, Vygotsky and his associates identified instances in which self-talk arose: to express frustration due to “a disruption in the smooth flow of activity,” to mark segments or transitions within the activity, to direct or plan the child’s progression, and to help in “raising the child’s acts to the level of purposeful behavior” (Vygotsky, 2002, pp. 30-31). This suggests that egocentric speech is used in order to process actions sequentially, overcome difficulties or unsuspected barriers, and regulate attention on the task at hand.

### **Review of Literature**

**Developmental progression of self-talk.** Several studies have validated Vygotsky’s proposal that egocentric or private speech transitions into inner speech as part of a developmental progression. It appears that once a student surpasses a certain intellectual age, his or her self-talk, also known as private speech, becomes internalized. Askeland (2012) and Glenn and Cunningham (2000) explored aspects of internalizing speech with different populations and found that at a certain age, children or young adults have reached the mental age where their self-talk becomes internalized into inner speech. Askeland performed a study in which students’ use of self-talk was determined based on their progression from 4<sup>th</sup> to 7<sup>th</sup> grade and their achievement level. The intervention group (I-group), who had “an intervention program where the goal was to stimulate private speech and internalization from audible to silent” (p.213) showed significantly more internalization of private speech than the control group (C-group) in the 4<sup>th</sup> grade (Askeland, 2012). However, in the results from the 7<sup>th</sup> grade I-group and C-group, the levels of internalization of private speech had become relatively similar (Askeland 2012). It appears that the students who participated in this study transitioned from private speech to inner speech

independently, regardless of whether or not they have received explicit instruction in this transitioning technique. Furthermore, Askeland (2012) determined that the students at the highest achievement level displayed the most significant difference in degree of internalization. This is in alignment with Glenn and Cunningham's (2000) study regarding young adults with Down syndrome and their use of private speech. They concluded, in agreement with Vygotsky, that "The most developmentally young (9% of the sample) showed no private speech; the most able (5%) had talked to themselves in the past, but no longer did so, indicating that they had now progressed to inner speech" (Glenn & Cunningham, 2000, p. 502). It appears that as Vygotsky proposed, a greater mental or developmental age, displayed by high achievement level in Askeland's study, relates to a greater level of internalization of private speech. While it appears that self-talk gradually becomes internalized, there are settings in which self-talk not only continues to exist, but can also be beneficial when used.

**Functions of self-talk.** Several studies have researched the use of self-talk in various realms both academic and non-academic. The use of self-talk in these settings will be described below.

***Athletic use of self-talk.*** In the athletic realm, a person's iterations to himself or herself are often involuntary, but purposefully "designed to enhance performance by stimulating desired actions through focusing on the technical aspect of the skill" (Kolovelonis, Goudas, & Dermitzaki, 2012, p. 221-222). The use of self-talk in this manner has been implemented to help people develop a new athletic skill in order to enhance performance. Research in physical education has been conducted to determine the interactional effects of forethought, performance, and self-regulation (Kolovelonis et al., 2012). Researchers provided 5<sup>th</sup> and 6<sup>th</sup> graders with specialized instruction on the use of self-talk in conjunction with process and/or outcome goal

setting while learning dart throwing, a completely new skill (Kolovelonis et al., 2012). During practice prior to the dart throwing evaluation, students were instructed to use self-talk after having seen it modeled by the experimenter and being continuously prompted to employ it with an emphasis placed on the word “stretch,” a technical skill of dart throwing (Kolovelonis et al., 2012). The use of self-talk aided these students in their performance on the final examination in comparison to peers who were not instructed in the use of self-talk; it is possible that this is due to the attention dedicated to the task and the fact that self-talk reduces the influence of other unnecessary strategies during performance. These findings suggest that strategically using and instructing self-talk by repetitively reciting a particular action and/or phrase, during the acquisition of a new physical task, leads to the more effective performance (Kolovelonis et al., 2012).

***Self-talk to regulate behavior.*** Several studies have shown that a student’s behavior and self-regulation can become more efficient with the use of self-talk. Callicott and Park (2003) emphasized the use of self-declaratory speech (SDS), defined as “a child’s verbalization when engaged in verbal behaviors of self-talk” (p. 49), as a means of managing classroom behavior for students with identified behavioral difficulties. Similarly, Manning (1990) strove to identify the relationship between types of self-talk (positive or negative) and behavior ratings by teachers. Both studies focused on the relationship of self-talk and behavior and determined that self-talk may be a useful component or technique to aid in a student’s behavioral regulation. However, Callicott and Park (2003) stressed the quality of the behavior, whereas Manning (1990) emphasized the type of self-talk. Callicott and Park were interested in determining how self-talk could assist students’ with emotional or behavioral disorders to self-manage. They performed four single-case withdrawals with four phases in which self-declaratory speech (i.e. self-talk)

was paired with a reinforcement at varying conditions (no reinforcement, with reinforcement, and delayed reinforcement). These reinforcements were presented to students in conjunction with the same math worksheet at the same time for 40 consecutive days. The researchers found that “moderate to strong effect sizes are evident for self-talk as a verbal stimulus antecedent for subsequent corresponding academic behavior” (Callicott & Park, 2003, p. 61). In other words, it appears that if self-talk is used as a precursor to engaging in academic behavior, a student will be more likely to effectively engage and self-regulate his or her attention to the task at hand (Callicott & Park, 2003).

Manning (1990) examined results of students who were given instruction on using self-talk, as a method of preventing negative behavior, and then recorded them at random 40 times during their regular class time. These recordings were analyzed based on type—positive, neutral, or negative—in order to determine the relationship between modes of self-talk and teacher ratings of behavior. Manning concluded that students who were rated with excellent behavior engaged in higher amounts of positive self-talk; students with average behavior the next highest; and students with poor behavior ratings the lowest amount of positive self-talk. Students rated with poor behavior in this study seemingly engaged in the most negative self-talk. The researchers propose the students negatively critique themselves because they are unable to control their behaviors and have difficulty focusing on their academic work (Manning, 1990). Results from both Manning (1990) and Callicott and Park (2003) suggest possible constructive benefits for students who are instructed on how to use positive self-talk. Along with considering self-talk, it is important to consider related forms of talk that may serve similar academic purposes and be more feasible in the classroom.

## **Exploratory Talk**

Exploratory talk is one form of communication that tends to exhibit similar functions to self-talk. According to Cazden (2001), exploratory talk is speaking without answers fully intact, analogous to first drafts in writing. Additionally, exploratory talk is “a social mode of thinking” and occurs when people engage with one another by evaluating each other’s ideas, accepting challenges, and reasoning with one another (Rajala, Hilppo, & Lipponen, 2012, p. 55). Although the intents of self-talk and exploratory talk are similar, the primary actions are performed aloud by a single person in comparison to multiple person discourse, respectively. Exploratory talk is enhanced by a collection of people who bring in a diverse wealth of expertise; this leads to more advanced processing and complexity of thought (Rajala, Hilppo, & Lipponen, 2012).

**Exploratory talk in academics.** Two studies have validated the importance of exploratory talk as a means for students to collaborate and build upon knowledge from one another; however, they each emphasize two different components necessary to establish functional exploratory talk. Rajala, Hilppo, and Lipponen (2012) highlighted the importance of expanded responses, statements that were linked to others’ declarations in their group, whereas Bee Tin (2003) focused on the students reaching their next level of ZPD with the facilitation of a more expert peer in order to develop efficient exploratory talk. Expanded responses are characteristic of inclusive exploratory talk and occurred when students were “supportively co-constructing and problematizing the topic” (Rajala et al., 2012, p.64). This indicates that merely agreeing with one student’s suggestion and advancing to the next topic, does not thoroughly enhance a student’s comprehension of the matter. Bee Tin (2003) elaborated on this suggestion by contending that exploratory talk only aids a group of students in determining the true answer of a convergent task if one student becomes the expert and aids the others in their advancement

through their ZPD. This seems to conclude that a variety of components are required for students to engage in productive exploratory talk; the inclusion of both expanded responses and advancement in students' ZPD fosters more successful and valuable exploratory talk. Using exploratory talk as a teaching strategy has potential benefits in helping students progress and achieve their goals.

**Connection to self-talk.** As shown through the literature, both self-talk and exploratory talk potentially aid students in making cognitive advancements, either through their advancement through ZPD or otherwise. The main distinction between them is that self-talk is talk with oneself, while exploratory talk is discourse between multiple people. The addition of multiple people, as mentioned above, has the ability to engage students with content and knowledge that may be above their current comprehension (Rajala, Hilppo, & Lipponen, 2012). Most importantly, both types of talks should be used with the purpose of achieving student cognitive advancement and could be supported by strategic teacher moves.

### **Teacher Moves and Talk Formats to Support Cognitive Advancement**

With the implementation of CCSSM, research has begun to focus on how teachers can facilitate student achievement of the new goals. A central aspect of this research is teacher "talk moves" that are designed to support mathematical thinking and learning and "talk formats" that represent the way a teacher structures classroom discourse (Chapin, O'Connor, & Anderson, 2009). These instructional discourse tools are related to instructional strategies, such as modeling and prompting, which are used with students in special education (Simonsen, 2013).

**Teacher moves related to discourse.** The use of these tools in the classroom, with the addition of self-talk, has the potential to be beneficial in achieving student cognitive advancement in mathematics. These tools will now be discussed in greater detail.

**Revoicing.** Revoicing is a talk move used by a teacher when he or she restates a portion or all of what a student said and ensures that it was an accurate interpretation. Typically, the teacher will repeat what the student has said in a clearer format, so the rest of the class comprehends, and then asks the original student if this is what they meant. This talk move is useful both when the student's reasoning is incorrect and when the reasoning is correct because it allows the rest of the class the opportunity to think about what has been offered. "Revoicing provides more 'thinking space' and can help all students follow what is going on mathematically", which will enable them to develop their own reasoning and participate actively in discussion (Chapin, O'Connor, & Anderson, 2009, p. 14).

**Repeating.** In this talk move, a teacher asks Student 2 to repeat what Student 1 has just said and refers back to Student 1 to verify if this was what he or she said. This talk move is beneficial because it gives students more time to process the original statement, allows them to follow the conversation more easily, and helps gain full participation. It is especially important for students who are English language learners because they are able to hear the reasoning more than once and prepare themselves to participate (Chapin, O'Connor, & Anderson, 2009).

**Reasoning.** This is a talk move used to engage the students in a respectful discussion of their ideas. A teacher often asks another student if he or she agrees with the original statement and why; this supports a student's mathematical learning and ideally allows the student to make significant cognitive advancements (Chapin, O'Conner, & Anderson, 2009).

**Wait time.** Allowing a student time to process what has been said regardless of the length of time necessary provides the opportunity for every student (especially ELLs) to become capable of participating in and feeling comfortable with the discussion. Few students have the ability to quickly generate an individualized response to the discussion and need this extra time

to thoroughly process what has been said (Chapin, O'Connor, & Anderson, 2009). Potentially, self-talk could be implemented during this wait time in order for students to think with themselves before participating out in the discussion.

**Modeling.** Modeling entails observing another's, usually someone more mature, educated, or expert, actions and learning from them (Simonsen, 2013). Teachers can use modeling as a technique to help students comprehend and complete the actions he or she desires. In order to advance students cognitively, a teacher should model providing good reasoning and explaining his or her reasoning to the class. This will help support mathematical learning and thinking in the classroom.

**Prompting.** Prompting is an instructional scaffold where a teacher or "model" gives a hint to a student so that he or she progresses towards the desired action (Simonsen, 2013). The types of prompts a teacher can use are: verbal, visual, gestural, and physical. In terms of classroom discourse, a verbal prompt would be used most often. This prompt could be in the form of a question, a helpful phrase, or reminder of the directions (Simonsen, 2013). In essence, the Chapin, O'Connor, and Anderson "talk moves" (i.e. revoicing, repeating, and reasoning) are forms of prompting. A prompting question focused on a student's reasoning, related to the teacher talk move reasoning, could be used to advance a student cognitively by asking him or her to think more deeply or expand upon his or her reasoning. These teacher moves, along with self-talk+, may take place in a variety of talk formats.

**Talk formats.** There are three talk formats described by Chapin, O'Connor, and Anderson, which can be used productively and unproductively in reaching student cognitive advancement.

***Whole-class discussion.*** In this type of instructional format, ideally students are sharing their thinking, providing logic to their reasoning, and building upon one another's contributions (Chapin, O'Connor, & Anderson, 2009). In this manner, the teacher is acting as a guide and allows the students to direct and create their own learning. In some instances, students do not have the source of mathematical knowledge that is necessary for comprehension and must rely on their peers through this social discourse (Chapin, O'Connor, & Anderson, 2009). When this talk format is used as described above, it is similar to exploratory talk because it aims to advance students cognitively through social interaction.

***Small group discussion.*** Small groups typically consist of three to six students who have been given a question to discuss among themselves, similarly to exploratory talk. The teacher often circulates and may interject in a particular group when appropriate (Chapin, O'Connor, & Anderson, 2009). There is the potential for students to become off-task if the teacher does not carefully structure roles and interactions. However, small group discussion, similar to partner talk, has the potential to be useful prior to engaging in whole class discussion.

***Partner talk.*** During partner talk, the teacher asks a question and then provides students with some time to discuss their thoughts with another person. Partner talk allows students to practice and further process their ideas before sharing their thoughts with the entire class (Chapin, O'Connor, & Anderson, 2009). Partner talk encourages students to talk aloud, something self-talk would also promote, allowing the student to begin to feel more comfortable sharing and processing his or her thinking externally. While partner talk is important for all students, students who are learning English, need more strategies to assist them in meeting the same standards as their peers.

## Language Considerations

**English language learners and bilingual classrooms.** Language is an important aspect of teaching in general, but for students who are English language learners (ELLs) language in the classroom is even more significant. Additionally because of the increasing number of ELL students who are enrolling in schools each year, it is crucial that we focus on their needs in the classroom (National Clearinghouse for English Language Acquisition, 2011; Truxaw, 2014). While the addition of ELL students should bring cultural diversity and cultural appreciation into schools, it is evident that schools are not servicing the students' academic needs adequately (Thorius & Sullivan, 2012). ELLs repeatedly perform below their peers, in math, science, reading, and writing assessments (Thorius & Sullivan, 2012). For example, the 2009 National Assessment of Educational Progress (NAEP) reported that across the United States, 12% of fourth-grade ELLs (in comparison to 41% of non-ELL peers) were at or above proficient levels in mathematics and that only 6% of eighth-grade ELLs (in comparison to 34% of non-ELL peers) were at or above proficient levels in mathematics (National Center for Education Statistics [NCES], 2009; Truxaw, 2014). Despite the discrepancy in performance, research suggests that there are many advantages to speaking more than one language (Alanís, 2000; Hakuta, 1986; Lindholm-Leary, 2001; Marcos & Peyton, 2000; Thomas & Collier, 2002).

Benefits of speaking more than one language, pertaining to cognition and academic ability, include greater cognitive flexibility, better problem solving, and use of higher order thinking skills (Hakuta, 1986; Marcos & Peyton, 2000). As a result of the beneficial aspects of learning multiple languages, there are reasons to advocate for bilingual or dual-language programs to benefit ELLs and also English-dominant students (Alanís, 2000; Lindholm-Leary, 2001). ELL students in bilingual classes learn English at the same rate as peers in English-only

programs and have been shown to perform at higher levels of academic achievement than students from English immersion programs when they reach high school (Thomas & Collier, 2002). Perhaps the cognitive flexibility and academic benefits of speaking more than one language in conjunction with the use of metacognition in the classroom will help ELL students breach the confounding juxtaposition between test scores and cognitive advantages.

**Metacognition and language.** Metacognition is often defined as “thinking about thinking” and helps a person evaluate whether a cognitive objective has been achieved (Livingstone, 1997). These metacognitive experiences usually occur before or after a cognitive activity and manifest when a cognitive activity is more difficult and a person is trying to make sense of what he or she is accomplishing (Livingstone 1997). Strategies such as self-questioning, story mapping, or planning often promote metacognitive thinking since they help a learner become aware of his or her cognitive strengths and weaknesses (Livingstone, 1997). It seems reasonable to consider that the greater cognitive flexibility a student garners by speaking more than one language can allow the student to engage in more metacognition, a beneficial educational technique. In looking for strategies to enhance a student’s metacognition, one may consider the use of self-talk to promote greater awareness of academic skills and shortcomings. As noted above, CCSS are pushing towards profound understanding and advanced reflections, these objectives are closely tied with the purposes of metacognition and can hopefully be achieved with the use of self-talk and related forms (from now on called “self-talk+”) and strategic teacher moves as educational strategies.

## **Conclusion**

**Summary.** As Common Core State Standards have pressed for more cognitive advancements, it is necessary for teachers to implement innovative strategies to reach these

objectives, especially for English language learners who are already struggling in comparison to their peers. Vygotsky's theories on communication directly relate to teaching and learning processes by advancing students through their ZPDs. From Vygotsky's theoretical perspective and through the review of literature, some methods of communication that have the ability to aid students in thinking metacognitively are self-talk, egocentric speech, private speech, and exploratory talk.

Self-talk is an individualized way for students to increase their understanding of a novel concept, re-direct and re-structure their thought process, or ruminate on a difficult matter (Vygotsky 2002). While this type of talk will not always be feasible in the classroom, methods of talk like exploratory talk, within the talk formats of partner talk or small group discussion, provide similar functions. Perhaps teachers can aide in such a profound development through the use of talk moves and promotion of self-talk or exploratory talk in order to reach the CCSS objectives and think metacognitively. These techniques may be particularly important for ELLs who need additional supports and strategies not only to reach the same achievement levels as their peers, but also help them fulfill the CCSS expected outcomes.

**Reflections and research questions.** After investigating self-talk+ and strategic teacher moves through a review of the literature, it appears that their use in the classroom may help achieve the CCSS in ways that have not been previously explored. In classrooms I have observed, there has been a heavy emphasis on teacher instruction and minimal opportunities for students to think metacognitively and reflect appropriately on the material that has been taught. For students who are bilingual or learning the English language, the cognitive benefits from speaking two languages may aid them in engaging in these strategies in a highly productive manner. Although it is proposed that self-talk transitions from external vocalizations to internal

thoughts, the purposes that I have explored throughout the literature review lead me to believe that the encouragement of self-talk+ in conjunction with the use of selected teacher moves in the classroom may be a way to support cognitive advancements expected by the CCSS. Reviewing Vygotsky's theory and the literature related to purposes of self-talk, exploratory talk, talk moves, language considerations for ELLs, and metacognition has led me to the following research questions:

- What are the purposes of self-talk+ in linguistically diverse elementary mathematics classrooms?
- What teacher moves associated with self-talk+ are present in these classrooms?
- What are observed and potential relationships across (among) self-talk+, teacher moves, and cognitive advancement in these classrooms?

## **Chapter 3: Methodology**

### **Context**

This research was conducted as part of a larger study in which data are being collected in several middle and elementary schools where Spanish is the primary language of some or all of the students. Spanish was chosen as the focus language, since it is the language spoken most frequently, other than English, in the United States (U.S. Census Bureau, 2013) and is the most common home language, other than English, for students enrolled in U.S. schools (NCELA, 2011). For this particular research, focus was placed on mathematics classrooms in two dual language programs (DLPs) in elementary schools in the western United States and the eastern United States. Some classroom recordings were collected in English, while others were recorded in Spanish. However, these classrooms used strategies to support emerging bilingual students regardless of language of instruction.

### **Focus Schools**

Garden School (all names are pseudonyms) is a K-5 elementary school located near an urban center in the western U.S. The school's 2011-12 school year profile reported that 706 students were enrolled, with 92% Hispanic or Latino, 48% English learners, and 85% eligible for free/reduced meals. Garden School's DLP uses Spanish and English as instructional languages. In this particular DLP, Spanish is used 90% of the time and English is used 10% of the time in kindergarten and first grade. As the students progress towards fifth grade, the percentage of use of Spanish/English shifts towards 50% by language. The DLP at Garden School is voluntary; families choose to have their children participate in the program. There are two DLP classrooms per grade level and the remaining classrooms are instructed in English only. Students in the DLP classrooms are primarily "native speakers" of Spanish

(<http://www.cal.org/jsp/TWI/SchoolView.jsp>). The principal shared assessment data, which revealed that students in the DLP performed above their peers, in the same school in the English immersion classes, on mathematics assessments (Personal Communication, October 2012)<sup>1</sup>.

East Brook School is a K-5 elementary school located in the eastern U.S. The school's 2012-13 school year profile reported that 511 students were enrolled, with 71.2% Hispanic, 46.8% come from homes where English is not the primary language, and 76.9% eligible for free/reduced meals. East Brook School is home to the district's DLP, which uses Spanish and English as instructional languages. The classes in the DLP are "integrated and balanced" so that each class contains half predominantly English speakers and half predominantly Spanish speakers. The main goals of the DLP "are to enable students to become bilingual, bicultural, bi-literate and, in the process, to reach their highest academic performance" (<http://sdeportal.ct.gov/Cedar/WEB/ResearchandReports/SSPReports.aspx>).

### **Data Sources**

Data for this investigation came from dual language elementary mathematics classrooms in the form of field notes, audio recordings, video recordings, transcriptions, and translations. Audio recordings were transcribed and transcriptions of those lessons conducted in Spanish were translated to English. The full data set included: three classroom lessons from a Kindergarten classroom in the western U.S., two classroom lessons from a 1<sup>st</sup> grade classroom in the western U.S., one lesson from a 5<sup>th</sup> grade classroom in the western U.S., one lesson from a 5<sup>th</sup> grade classroom in the eastern U.S., and one lesson from a 1<sup>st</sup> grade classroom in the eastern U.S. From this full data set, focus classrooms were identified for this research, as described below in the "Focus Teachers" and "Analysis" sections. The mathematics lessons in the focus classrooms

---

<sup>1</sup> Personal communication took place between the PI of the larger research project and the principal of the school.

were conducted in Spanish—three lessons from a Kindergarten classroom in the western U.S. and one lesson from a 5<sup>th</sup> grade classroom in the eastern U.S.

### **Focus Teachers**

Two teachers and their classrooms were purposefully selected for particular focus from among the teachers from the larger study. The process and reasons for their selection are described in the “Data Sources” and in the “Analysis” sections. The two focus teachers are described next.

**Grade K—Señora Plata.** Three lessons from a kindergarten class in the DLP at Garden School will be used to demonstrate how student talk and teacher moves can be used in conjunction with another to reach metacognition or other student cognitive advancements. At the time of observation, the teacher, Señora Plata (Sra. P), had 14 years of teaching experience. She had 10 years of experience teaching in a DLP and had taught kindergarten in the DLP for three years. In addition to her elementary teaching certification, Sra. P had specialized certification to teach in the DLP. There were 20 students in the class (7 boys and 13 girls), who were predominantly from homes where Spanish was the first language. Her lessons were conducted in Spanish.

**Grade 5—Señora Cruz.** One lesson from a fourth grade classroom in the DLP at East Brook School will be used to demonstrate how student talk and teacher moves can be used in conjunction with one another to reach metacognition or other student cognitive advancements. At the time of the observation, the teacher, Señora Cruz (Sra. C), had 28 years of teaching experience and 20 years of teaching mathematics. She had been teaching for 17 years in a DLP and had taught in this placement in East Brook School for three years. Sra. C had a special

teaching certification to teach in a DLP in addition to her master's in elementary education. Her lesson was conducted in Spanish.

## **Analysis**

**Grounded theory methodology.** Data were analyzed using grounded theory methodology and constant comparative methods (Strauss & Corbin, 1990). A constant comparative method means that the researcher continuously reviews and analyzes the data to inform the development of new ideas and theories. In this case, the theory being developed relates to two main ideas: (1) the impact of *self-talk+* (self-talk and related forms of talk) and students' use of advanced cognitive skills and (2) *self-talk+* in conjunction with teacher moves and students' use of advanced cognitive skills. Specifically, video recordings, audio recordings, and line-by-line coding of transcriptions and translations were analyzed to identify purposes of these main ideas.

**Initial coding.** The process included the following. I watched the videos of seven lessons from the larger study to obtain an understanding of classroom dynamics, class activities, and teacher and student roles in dual language mathematics classrooms. I listened to the audio recordings and reviewed transcripts in order to identify several themes that were present and aligned with similar themes that emerged from my review of literature. I used open coding (Strauss & Corbin, 1990) to identify preliminary themes. While comparing these initial themes from the transcripts with those in the literature, I used axial coding in order to establish connections among the categories. I identified the following coding categories as particularly significant: self-talk, exploratory talk, partner talk, prompting, modeling, wait time, and metacognition. I developed definitions, aligned with research literature, for each of these codes

in order to support further coding and analysis. See tables 1, 2, and 3 for definitions of each of these codes.

Table 1  
*Related Forms of Talk*

<b>Related Form of Talk</b>	<b>Definition</b>
Self-talk	Individualized way for students to increase their understanding of a novel concept, re-direct and re-structure their thought process, or ruminate on a difficult matter. (Vygotsky, 2002)
Inner speech or private speech	“Speech for oneself, intimately and usefully connected” to thinking (Vygotsky, 2002, p. 228)
Exploratory Talk	Talk with others that is essentially a verbal rough draft (Cazden, 2001; Rajala, Hilppo, & Lipponen, 2012)
Partner Talk	Talking with a partner in a classroom as an instructional strategy

Table 2  
*Cognitive Advancement/Processing Tool*

<b>Cognitive Advancement/Processing Tool</b>	<b>Definition</b>
Zone of Proximal Development (ZPD)	Distance between what one can do independently compared to what one can do in collaboration with more capable others (Vygotsky, 1978)
Metacognition	Thinking about thinking (Flavell, 1981; Livingstone, 1987)

Table 3  
*Teacher Moves*

<b>Code</b>	<b>Definition</b>
Modeling	Observing another’s actions and learning from them, usually someone more mature, educated, or expert (Simonsen, 2013)
Prompting	An instructional scaffold where a teacher or “model” gives a hint to a student so that he or she progresses towards the desired action (Simonsen, 2013)
Revoicing	When a teacher restates a portion or all of what a student has said and ensures that it was an accurate interpretation (Chapin, O’Connor, & Anderson, 2009)
Repeating	A teacher asks Student 2 to repeat what Student 1 has just said and refers back to Student 1 to verify if this was what he or she said (Chapin, O’Connor, & Anderson, 2009)

Reasoning	A teacher asks another student if he or she agrees with the original statement and to explain why (Chapin, O'Connor, & Anderson, 2009)
Wait time	Allowing a student time to process what has been said and respond regardless of the length of time necessary (Chapin, O'Connor, & Anderson, 2009)

---

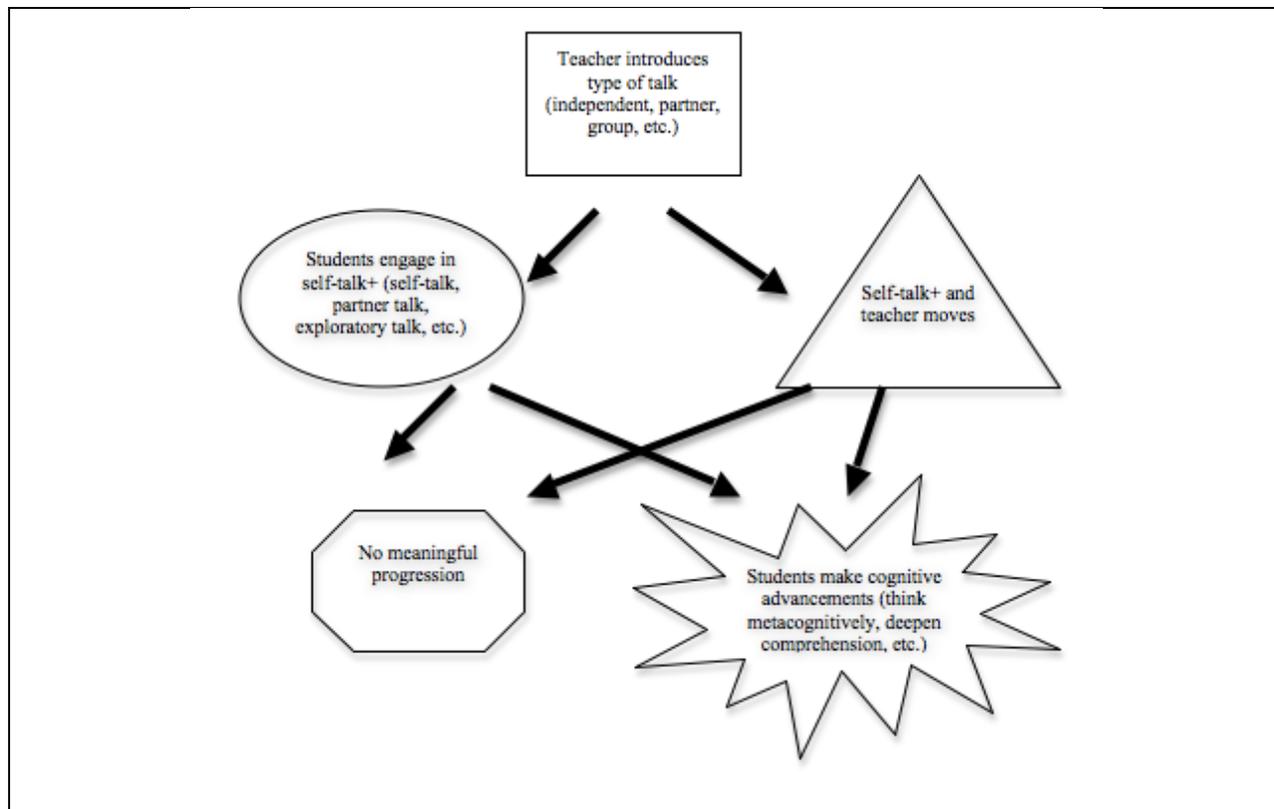
**Definitions.** Using the definitions as guides, I re-reviewed the transcripts, in conjunction with the videos, and marked the dialogue in which the relevant themes (listed above) were revealed. I then watched the videos and read the transcripts multiple times. The constant comparative method informed my analysis.

**Selected focus lessons.** After developing initial codes, I selected the focus lessons (as described in “Data Sources”). These lessons were purposefully selected because they illustrated the interconnectedness of themes most strongly and advanced my theory. This selection is aligned with constant comparative methods (Strauss & Corbin, 1990) where there is interplay between data collection and analysis.

**Key moment analysis.** After reviewing videos and transcripts, it became clear that it would be instructive to look at specific moments when students had the opportunity to reflect upon their academic understanding. These moments included the use of an academically relevant type of talk and teacher involvement in academic advancement. I revisited the video and transcripts in conjunction to re-analyze the moments; determine the most evident themes; and identify the purpose of the type of talk, the teacher moves, and the outcome for the student. Here is an example of a key moment analysis within the context of a Kindergarten classroom in which students were creating equal groups from objects based on similar characteristics:

Speaker/Time (Video)	Discourse (Spanish)	Discourse (English)	Self-talk+, Teacher Moves, Analysis
Teacher/31:46	“Estós son tús grupos? Por qué?”	“These are your groups? Why?”	Prompting to think metacognitively about why grouped in this way
Student 1/31:47	“Porque...(inaudible)”	“Because...(inaudible)”	Student responds to the question with reasoning
Teacher/31:49	“Y estos solamente...”	“And these ones by themselves...”	Prompting to think about the objects left out
Student 2/31:52	“No, no, no...(inaudible)” Student reaches to move the objects on the table	“No, no, no...(inaudible)” [Student reaches to move the objects on the table]	Potential for engaging in exploratory talk, reasoning with one another
Teacher/32:00	“Por qué vaya este?”	“Why does this one belong?”	Prompting to think metacognitively about why they sorted that one in a certain way
Teacher/32:11	“Pero este no es mariposas?”	“But, this one isn’t a butterfly?”	
32:13-32:28	Inaudible; Two students are looking around confused, not actively participating in the group	Inaudible	Exploratory talk is not working as effectively, potential for another type of self-talk+ to be used
Teacher/32:29	“Pero para mi esto no va en este grupo. Por qué es que? Mira escucha como dice por qué.”	“For me this one doesn’t belong in this group. Because why? Listen to how he says why.”	Encouraging the students to engage in this type of exploratory talk and explain to one another their reasoning behind their decisions
Student 2/32:37	“Porque solo son dos.”	“Because there are only two.”	

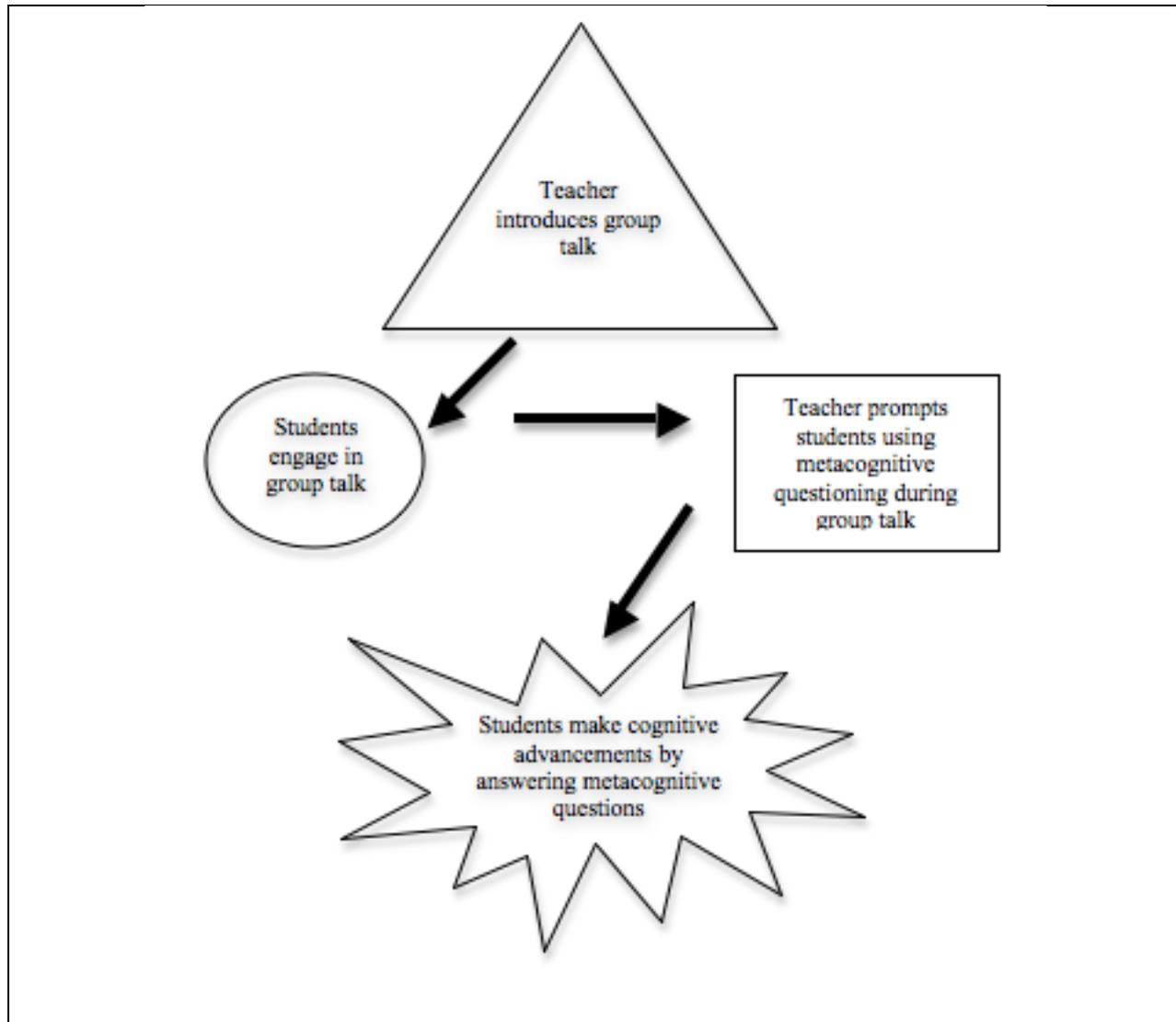
**Mapping.** I then developed a model for mapping and describing the various combinations of themes that occurred and could potentially occur in classrooms. I re-reviewed all the key moments I had transcribed and identified the key moments that most informed my research questions. I mapped those strongest key moments from the transcripts and videos onto my general map to analyze the similarities and differences between these crucial actions and determine patterns between them. An example of the general map is displayed below (Figure 1):



*Figure 1.* General Map of relationships among self-talk+ and teacher talk moves.

The map above shows all the potential relationships between self-talk+ and teacher talk moves.

Not all the maps used to represent the data will include all of the components shown above. An example of a potential scenario will be displayed and described below (Figure 2).



*Figure 2.* Potential scenario map.

In this particular scenario above, the teacher introduces group talk and students then engage in group talk. During this group talk, the teacher walks around and asks the students questions aimed at reaching metacognition. The students are able to answer these questions correctly and are ideally making cognitive advancements.

## Chapter 4: Results and Discussion

In this section, I will describe and discuss the results of each of the research questions. I will illustrate analysis of the various scenarios through selected excerpts of transcripts and mapping that demonstrates the interactions between self-talk+ and strategic teacher moves. Then I will summarize the results of each question.

### Purposes of Self-talk+

Self-talk+ refers to self-talk and related forms of talk (partner talk and exploratory talk) that occur naturally or by teacher initiation in a classroom. After analyzing transcripts, audio recordings, and video recordings from three selected lessons in two purposefully selected classrooms, I have found the following purposes of self-talk+ in these classrooms: ruminate on a difficult matter, increase understanding of a novel concept, redirect/restructure thought process, focus on technical aspects of a skill, effectively engage with a task, and increase understanding of a novel concept. Although these purposes are described individually, some examples may coincide with more than one purpose. These purposes will now be discussed in greater detail.

**Ruminate on a difficult matter.** After analyzing data, I have found a purpose of engaging in self-talk+ in the classroom that was consistent with the literature, *ruminating on a difficult matter*. Students often engage in self-talk+ independently or with others when they are expressing frustration, conveying excitement upon successfully processing the matter, questioning how another student conceptualized the matter, or trying to determine how to process the matter at hand. In example A (see Table 4), the students in Sra. C's Spanish language fifth grade classroom were investigating decimals, specifically the meaning of place value within the decimal. The analysis suggests that, after thinking deeply about the topic, one student engaged in self-talk in order to express his frustration upon being unable to comprehend the

difficult subject matter. The student demonstrated frustration when he said, “I get confused because sometimes it’s the little ones and sometimes it’s the big ones.” Another interesting point is that, the student engaged in self-talk in *English*, although the language of instruction and discussion was Spanish<sup>2</sup>. This is an example of allowing students in DLPs with the opportunity to engage in self-talk in the language of their choosing. There is research to suggest that allowing some code-switching in bilingual classrooms (Moschkovich, 2007) could potentially lead to more productive and meaningful self-talk. In example B (see Table 4), two students were engaging in exploratory talk in order to think deeply about the question, “Which is smaller, 0.101 or 0.01?” Upon ruminating on this question, one student was still confused by the question and asked his partner, “¿Pero cómo lo determines?” (“How do you determine it?”). The analysis suggests that this student was acknowledging how difficult the problem was, expressing his frustration about being unable to comprehend, and trying to reach a solution by relying on his partner’s knowledge. In connecting back to the research literature, this situation provides an opportunity for the second student (whose response was inaudible), to help the first student understand the question and solution, potentially advancing the student through his zones of proximal development (Vygotsky, 1978). Both of these examples show students using self-talk+ to more deeply reflect upon the difficult subject matter they are learning.

Table 4  
*Ruminate on a Difficult Matter*

Example	Self-talk+/Code	Transcript (Spanish)	Transcript (English)	Context	Purpose, Analysis
A	Self-talk		S: “I don’t know! I get confused because sometimes it’s the little ones and sometimes it’s the big ones...”	Students are being asked to solve and reason with a decimal question	Ruminate on a difficult matter, student is expressing confusion

<sup>2</sup> This is an example of code-switching—that is, switching between two languages.

B	Exploratory talk	S1 to S2: “¿Pero cómo lo determines?”	“How do you determine it?”	Students were asked to work in partner pairs to answer the question “0.101 vs. 0.01, which one is smaller?”	Ruminate on a difficult matter, student is asking another student how they figure out the problem
---	------------------	---------------------------------------	----------------------------	---	---

**Increase understanding of a novel concept.** A purpose of self-talk+ I discovered through analysis, which is related to advancement through a student’s zone of proximal development (Vygotsky, 1978), is to help students *increase their understanding of a novel concept*. As revealed in the literature (Bee Tin, 2003), this typically occurs when students engage in talk with other peers. While analyzing data, I noted that this purpose of self-talk+ occurred when students were engaging with others in efforts to complete and process a new task. In the example below (see Table 5), kindergarten students were asked to group objects together based on characteristic similarities they identified. It appeared that students were completing the task for the first time, but were given a fair amount of independence in doing the assignment. The teacher explicitly encouraged partner talk with phrases like, “Habla con tus amigos” (Talk to your friends”). By talking in partner pairs, the students were able to bounce ideas off one another, reflect on each other’s ideas, and come up with joint ideas. The use of self-talk+ in this manner contributed to their completion and understanding of this new activity.

Table 5  
*Increase Understanding of a Novel Concept*

Self-talk+/Code	Transcript	English Translation	Context	Purpose, Analysis
Partner talk	T: initiates partner talk “Cuales grupos van a ser? Cuales son iguales? Habla con tus amigos.” SS engage in talk	T: initiates partner talk “What groups are you going to make? Which ones are the same? Talk to your friends.” SS engage in talk	Students are categorizing objects into groups based on their own interpretations of how they would go together.	Increase their understanding of a novel concept and effectively engage with a task, students are doing something new and engaging with the task/others to better understand what they are doing

**Redirect or restructure thought process.** Another purpose of self-talk+ that coincides with the literature is for students to *redirect or restructure their thought process*. This purpose elaborates upon a characteristic of exploratory talk in which students should be “supportively co-constructing and problematizing the topic” (Rajala et al., 2012, p.64). Oftentimes, students engage in self-talk+ when they are confused about the answer, want to determine the correct answer, or are assisting their peer in determining the answer. Redirecting or restructuring a students’ thought process helps students further engage in the process of obtaining answer or solution. This purpose builds upon the literature by analyzing how students can reflect on one another’s thought processes. In the example below (see Table 6), students were asked to work in partner pairs to answer the question, “0.101 vs. 0.01, which one is smaller?” Two students engaged in discussion and were reflecting upon how the other conceptualized and processed the question. Student 1 said to the other, “No tú te deciste decimales” (“No you said it was decimals”). This student was attempting to help Student 2 restructure his thought process by pointing out a slight misconception or incorrect step. The rest of the conversation was inaudible, but the student made an effort to help the student reflect upon his thinking. The use of partner talk in this manner, builds upon the purposes of self-talk+ found in the literature by engaging the students in discussion regarding thought process, not only solution or topic.

Table 6  
*Redirect or Restructure Thought Process*

Self-talk+/Code	Transcript	English Translation	Context	Purpose, Analysis
Partner talk	S1 to S2: “No tú te deciste decimales.”	S1 to S2: “No, you said it was decimals”	Students were asked to work in partner pairs to answer the question “0.101 vs. 0.01, which one is smaller?”	Redirect and restructure thought process, students are correcting one another and helping each other understand reasoning

**Focus on technical aspects of a skill.** A purpose of self-talk+ that was uncovered in the literature (Kolovelonis et al., 2012) and further identified during my analysis is *focusing on a technical aspect of a skill*. In the literature (Kolovelonis et al., 2012), self-talk is used as a verbal repetition tool in order for students to focus on learning a new physical action in an athletic setting. My analysis has further uncovered the benefit of using self-talk for this purpose in the classroom. In one kindergarten classroom I analyzed, the students used self-talk to focus on technical aspects of a skill of learning how to write new numbers. In example A (see Table 7), the students were learning how to write the number six. When describing how to write the number, the teacher had said, “hasta el linea de abajo” or “to the bottom line”. After hearing this, some students repeated the phrase their teacher used, “to the bottom line” to themselves, while physically writing the number. In this instance, the students were reinforcing the way to write the number six and focusing on the technicality of drawing the number. In example B (see Table 7), a similar situation occurred when the students were learning to write the number seven. One student repeated a phrase the teacher had instructed them to use, “diagonal”, in order to focus on physically writing the number seven. The use of physical repetition and self-talk of a key phrase, assisted the students in focusing on the technicality of writing new numbers.

Table 7  
*Focus on Technical Aspects of a Skill*

Example	Self-talk+/Code	Transcript	English Translation	Context	Purpose, Analysis
A	Self-talk	T: "Hasta el linea de abajo" S repeats: "Hasta el linea de abajo"	T: "To the bottom line" S repeats: "To the bottom line"	Students are learning how to draw the number six	Focus on technical aspects of a skill, students are physically copying the number over and repeating the directions
B	Self-talk	T: "Linea...despues un diagonal" S repeats to self: "Diagonal"	T: "Line...and then a diagonal" S repeats: "Diagonal"	Students are learning how to draw the number seven	Focus on technical aspects of a skill, students are physically copying the number over and repeating the directions

**Effectively engage with a task.** A purpose of self-talk+ I uncovered throughout analysis is to assist students in *effectively engaging with a task*. This is related to the purpose of directing attention to the task at hand, which was discussed in the literature in conjunction with behavior management (Callicott & Park, 2003; Manning, 1990). In the literature, students use self-talk as a means of preventing engagement in behaviors unrelated to the task at hand. Throughout my analysis, I have noticed that students engage in self-talk+ for the purposes of effectively engaging with a task, without needing it for behavior management assistance. In the kindergarten classroom, students engaged in self-talk as a means of processing the directions and completing the assignment as requested. In example A (see Table 8), students used self-talk by repeating the directions for part of the task they had been given in order to accurately complete the assignment and efficiently process what the teacher is saying. This assists the students in directing their attention to the task at hand to ensure they are only engaging in the assigned task.

In example B (see Table 8), students also use self-talk in order to focus on the task they are completing. The kindergarten students were asked to write the name and number of objects displayed on the board. In order to engage with and complete the task correctly, some students counted out loud. This verbal self-talk benefitted the students by ensuring they were counting accurately and obtaining the correct result. Both examples display the benefits of using self-talk+ as a means for effectively engaging in a task.

Table 8  
*Effectively Engage with a Task*

Example	Self-talk+/Code	Transcript	English Translation	Context	Purpose, Analysis
A	Self-talk	T: "Dos rojas...dos rojas" SS quietly repeat to themselves	T: "Two red...two red" SS quietly repeat to themselves	Students are being asked to draw the number of objects the teacher is saying out loud	Effectively engage with a task, students are repeating the teacher to process what she is saying more efficiently
B	Self-talk	T: "Vas a trabajar si mismos"	T: "You are going to work by	Students are asked to write	Effectively engage with a task, student are saying

		Students count aloud to themselves	yourselfes” Students count aloud to themselves	the name and amount of the objects she is showing on the board	the numbers out loud so they can be sure they are counting correctly
--	--	------------------------------------	---	--	--

**Summary of purposes of self-talk+.** The purposes of self-talk+ I have uncovered during data analysis are consistent with the literature, but provide a new context or an additional emphasis. The purposes delineated above include: ruminate on a difficult matter, increase understanding of a novel concept, redirect/restructure thought process, focus on technical aspects of a skill, and effectively engage with a task. A similarity across these purposes reveals that they may assist students in advancing through their ZPD in more than one way, an indicator of cognitive advancement. These purposes will inform my next research questions and further analysis.

#### **Teacher Moves Associated with Self-talk+**

During initial analysis, all teacher moves described in the review of literature were considered. As analysis continued, axial coding was used to collapse some teacher moves into broader categories—for example, revoicing, repeating, and reasoning were all coded as “prompting” because they are used to prompt students to think more deeply about their learning. Wait time and modeling were considered distinct categories. Examples of these teacher moves (wait time, modeling, and prompting) used in conjunction with a type of self-talk+ will be described in further detail.

**Wait time and prompting post partner talk.** One example of wait time seen once in the fifth grade classroom occurred after students had previously engaged in partner talk regarding the value of decimals. The students had come up with three different answers for what a

“decimo” or tenth was: A) 10 [ten], B) 0.1 [one tenth], and C) 0.10 [ten hundredths]<sup>3</sup>. The teacher asked one student why she believed it was one of those answers, transcribed below.

Speaker/Time (video)	Spanish	English Translation	Teacher Move
Teacher/9:57	“Por qué tú piensas que es B?”	“Why do you think it is B?”	Prompting to think about why
Student/9:59	“Yo pienso que es B porque...yo se que un...uh, un que tiene ‘value’?”	“I think it’s B because...I know that a...a, uh, that has value?”	
Teacher/10:12	“Un valor?”	“A value?”	Wait time approximately 10 seconds
Student/10:15	“Un valor despues del punto es un decimo”	“A value after the decimal point is a tenth.”	

The teacher, prior to saying whether the student’s answer was correct or not, prompted the student to think about why she believed answer B was a tenth. This move suggested that she wanted the student to think more deeply and determine a reason for why she believed in her response. Additionally, when the student was confused about the term, the teacher waited approximately 10 seconds in order for the student to come up with her own answer before interjecting. Interestingly, the student used the English term for the word she was trying to come up with instead of the Spanish (another example of code switching). The teacher’s move promoted the student’s use of Spanish and by allowing the student the time to think about her answer and come up with the word, she let the student take control of her own learning process. While the teacher gave the student wait time, the student appeared to be processing all the information and determining a solution, effectively engaging in self-talk in her head. By allowing the student these few seconds to truly process her thoughts, the teacher helped the student advance cognitively to understand the material more thoroughly.

**Modeling and prompting during partner talk.** In the fifth grade classroom, students were instructed to use manipulatives to represent the value of decimal numbers and ask their

---

<sup>3</sup> Though B and C are equivalent, the teacher was asking which of the answers was “one tenth”.

partner which set of manipulatives represented the largest value. The teacher came over to a group of two students, who were having difficulty arranging their manipulatives in the way instructed. As a result, she modeled how the students should be asking each other prompting questions about which quantity of manipulatives was larger than the other, example below.

Speaker/Time (video)	Discourse	English Translation	Teacher Move/Self-talk+
Teacher/26:10	“Preguntálo, cual es el más grande, el tuyo o el?”	“Ask him which one is bigger, yours or his?”	Modeling question asking, prompting them to engage in partner talk
Student/26:13	“Cuál es más grande, el mio o el tuyo?”	“Which one is bigger mine or yours?”	Partner talk

In this instance, with the teacher’s prompting and modeling, the students were able to engage in a more effective partner talk and complete the desired activity. Prior to the teacher’s intervention, the students had not been using the manipulatives or engaging in discussion the way the teacher had intended. The teacher’s interventions allowed them to ultimately complete the desired activity and ideally learn the correct mathematical knowledge. The partner talk following the modeling and prompting of the teacher had more potential of increasing the students’ understanding and allowing them to make cognitive advancements.

**Modeling before self-talk.** In the kindergarten classroom, students were working on drawing quantities of objects based on verbal descriptions by the teacher, example below.

Speaker/Time (transcript)	Discourse (Spanish/English)	English Translation	Teacher Move/Self-talk+
Teacher/15:15	“Vamos a hacer siete niños son en fila para ir a la feria, ponen los numeros. Empieza por favor.” Teacher draws/models 7 children in a line on board	“We are making 7 children that are in a line to go to the fair, put the numbers. Please begin.”	Modeling
Students/15:28	Quietly to themselves, students say, “Uno, dos, tres, cuatro...”	Quietly to themselves, students say, “One, two, three, four...”	Self-talk

The teacher’s modeling resulted in the students engaging in self-talk to effectively complete the required activity. Although the teacher did not explicitly direct the students to talk through the problem to themselves, after the modeling, the students needed a way to process and complete

the assignment. Self-talk enabled the students to engage more effectively with the assignment and reflect on what they were doing independently.

**Prompting during partner talk.** In the kindergarten classroom, students were using manipulatives to make patterns with a partner. The students were creating their own patterns without a guide. The teacher circulated and talked with groups, prompting them to think more deeply about their patterns. An example interaction from one group is shown below.

Speaker/Time (transcript)	Discourse (Spanish/English)	English Translation	Teacher Move/Self-talk+
Teacher/37:07	“Por qué hay un amarillo aquí y dos amarillos en estó?”	“Why is there one yellow in this one, but two in the other one?”	Prompting them to think about their pattern more closely

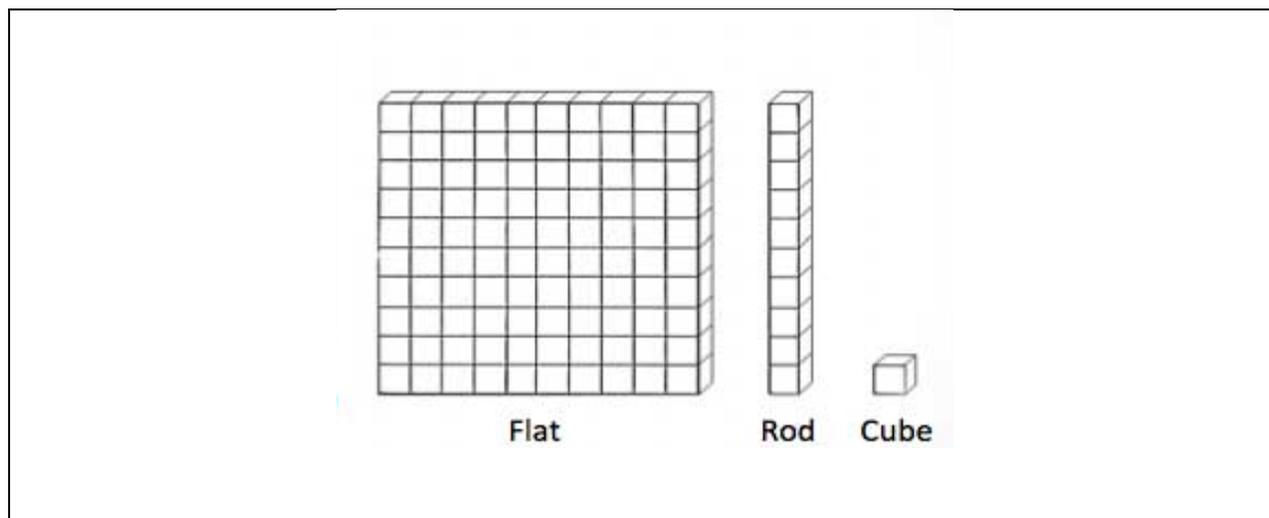
In this instance, the teacher was not telling the students if they were right or wrong, but instead was prompting them to thinking more about their pattern and decide themselves if they think it is accurate or not. This allowed the students to be in control of their own learning and mathematical understanding. The teacher’s use of prompting enhanced the students’ partner talk and enabled them to comprehend the material at an elevated cognitive level, specifically thinking about their own thinking or metacognition.

**Summary of teacher moves associated with self-talk+.** Teacher moves and self-talk+ have the potential to be combined in various ways. Upon analyzing a variety of different combination found in the data, a commonality between them is that the use of teacher moves and self-talk+ has the potential to increase a students’ understand and/or help them make cognitive advancements. While both are beneficial to students independently, the combination of these two actions appears to have greater benefits.

## Observed and Potential Relationships Across Self-talk+, Teacher Moves, and Cognitive Advancement

When used together, self-talk+ and strategic teacher moves have the potential to help students make cognitive advancements—think metacognitively, advance along through their ZPD, or understand a concept more clearly. However, these cognitive advancements are not always the product of engagement in self-talk+ with teacher moves. From the data collected and analyzed, I have identified three incidents in which self-talk+ and teacher moves were combined in the efforts of having students make cognitive advancements. The data will be displayed and discussed below.

**Example 1—East Brook School, 5<sup>th</sup> grade.** Students in this classroom were asked to use base ten blocks to represent numbers with decimals and compare which number (quantity) was larger. The teacher modeled using flats to represent ones, rods to represent tenths, and unit cubes to represent hundredths (see Figure 3).



Flat=one (uno); Rod=one tenth (décimo); Unit Block=one hundredth (centésimo)

Note: Traditionally, flat=100; rod=10; unit cube=1. The teacher adjusted for decimal representations.

*Figure 3.* Base ten blocks used to represent decimal numbers in this classroom.

The teacher had instructed the students to work with a partner on a few number comparisons.

Each student received a designated number to compare with their partner's number; the partners

needed to represent the numbers using base ten blocks and decide which of the numbers (quantities) was larger. The teacher walked around and conferred with each group, asking questions such as, “¿El tuyó es más grande qué el de ella?” (“Yours is bigger than hers?”). These questions prompted the students to think more deeply about their answers, without immediately stating if their answer was correct or not; ideally, the students were thinking more metacognitively about why they believed their answer was correct. One partner pair struggled to understand how to represent the numbers with the base ten blocks. The teacher’s interaction with them went as follows.

<b>Speaker/Time (Video)</b>	<b>Discourse (Spanish/English)</b>	<b>English Translation</b>	<b>Self-talk+, Teacher Move, Analysis</b>
Teacher/28:13	“Esto es un decimo de esto”	“This one is a tenth of this one”	
Student 1/28:15	Inaudible		
Student 2/28:18	“No ese es” points to manipulative	“No, this one is that” points to manipulative	Not clear which manipulative the student is pointing to
Teacher/28:20	(Inaudible)...”estó es un centécimo? ¿Estó es un entero, so cuantos van a ser?”	(Inaudible)...”this one is a hundredth. This one is a whole, so how many are you going to have?”	Prompting question to make the students think more deeply
Discussion	Inaudible		
Teacher/28:45	“A ella le toca a hacer, yo cogí los décimos.”	“It’s her turn to do it, I picked the tenths.”	Teacher is facilitating partner interaction
Student 2/29:00	“Pero estó es tres y el otro es...”(inaudible)... “y estó es...”	“But, this one is three and the other is...(inaudible)...and this one is...”	Student is confused about which quantity of manipulatives represents the number
Teacher/29:09	“Estó es centécimos. Tú vas a hacer tres y estó es un décimo.”	“This is the hundredths. You are going to have three and this is one tenth.”	Teacher is modeling which manipulative represents the numbers and helping students understand how many they need
Teacher/29:17	“Si tú compáras la tuya con ella es más valor, verdad?”	“If you compare yours with hers, yours has a higher value, right?”	Teacher asks them a question to see if they have understood her modeling
Students/29:20	Inaudible, but students seem to agree		
Teacher/29:22	“Entonces, hagan el proximo lo mismo.”	“Okay, do the next one the same way.”	
29:23-30:04	Students chatter and start the next comparison		
Student 1/30:05	“El tuyó es más grande que el míó...”	“Yours is more than mine...”	Students are capable of completing the problem themselves

In this scenario, the teacher modeled how to represent the numbers with manipulatives in order for the students to be able to complete the assignment in their partner group. Without the modeling, the students would have potentially confounded not only the representation of the numbers with manipulatives, but also how to compare the value of the numbers—the true objective of the assignment. After having the activity modeled in greater detail and working together to alleviate some of their misconceptions, it appears that the students were able to complete the next number comparison, signifying that they potentially have a better understanding of the activity and the general concept of comparing numbers with decimals. A map of this scenario is displayed below (Figure 4). In the map, you can see that the teacher introduced partner talk, the students engaged in partner talk, but seemed confused. The teacher then modeled and prompted and then the students were able to deepen their understanding.

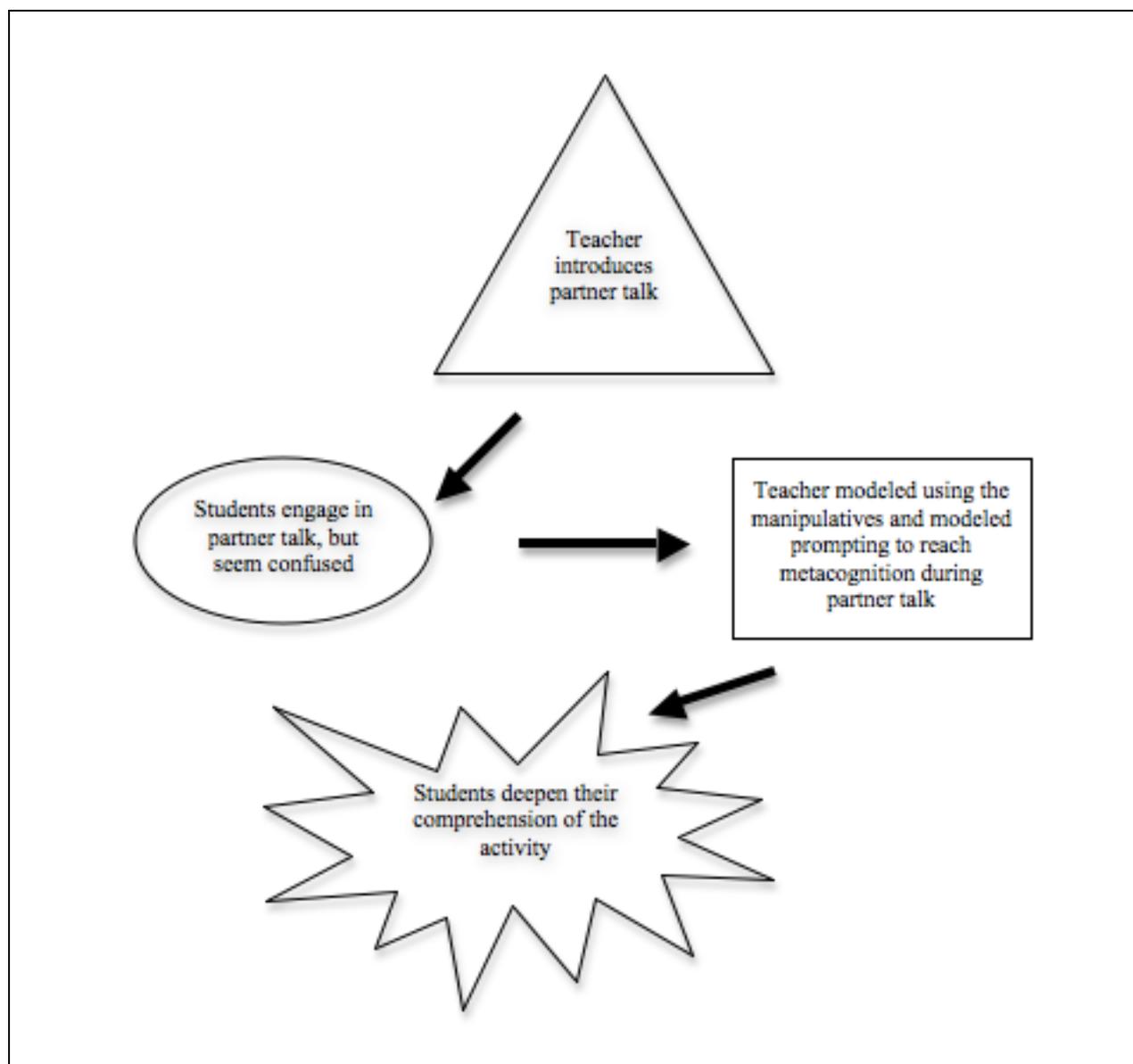


Figure 4. East Brook School, 5<sup>th</sup> grade, base ten blocks.

**Example 2—Garden School, Kindergarten.** During this activity, students were looking at patterns and determining which object in the pattern did not belong. The teacher’s moves suggested that she not only wanted the students to determine which one did not belong, but also to be able to say why it did not belong in the pattern. She introduced this by using questions that prompted the students to think metacognitively about why the object did not fit in with the pattern, such as, “¿Por qué no va?” (“Why does it not belong?”). The students were originally

working independently on this activity and then the teacher decided to have them work in partners so they could talk and tell one another their reasoning for why the object did not belong.

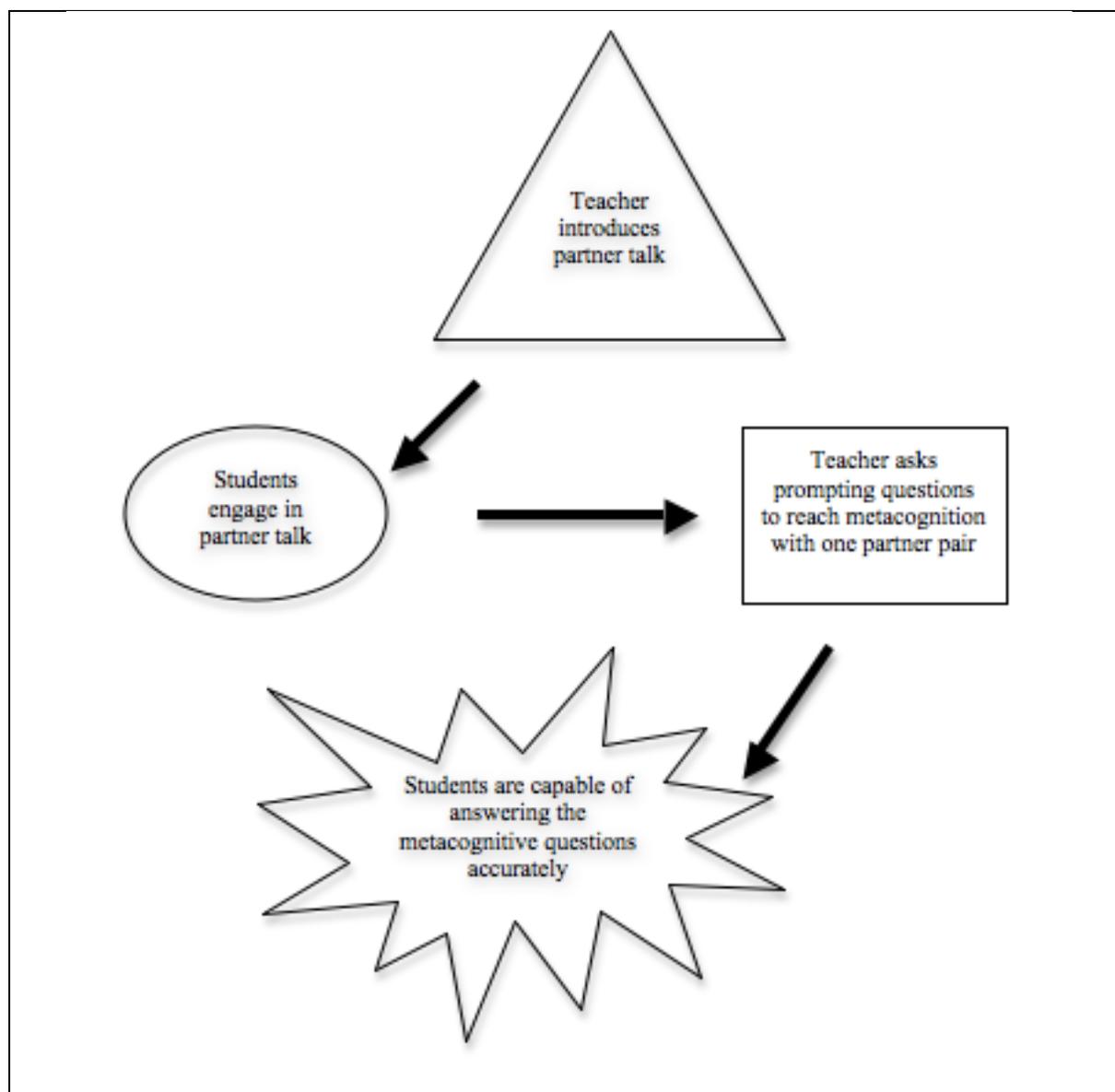
The teacher's directions and progression of the classroom dialogue were as follows.

<b>Speaker/Time (Video)</b>	<b>Discourse (Spanish/English)</b>	<b>English Translation</b>	<b>Self-talk+, Teacher Move, Analysis</b>
Teacher/26:03	"Me vás a decir cual no vá"	"You are going to tell me which one does not belong"	Teacher is giving directions
Teacher/26:26	"Decirme por qué no va?"	"Tell me why it does not belong"	Teacher prompts students with a question to think metacognitively
Students/26:30	Can hear students repeating "Cuál no va?" quietly to themselves	Can hear students repeating "Which does not belong?" quietly to themselves	Students are self-talking, repeating what the teacher is saying. Potential to think metacognitively out loud.
Teacher/27:00	"Sabén lo que pueden hacer? Pueden trabajar en grupo. Trabaja con tu amigo."	"Know what you can do? You can work together. Work with a friend."	Teacher decides to transition from independent work to partner work. Potential for students to work together, and think more deeply.
Teacher/27:07	Pairs students together, their discussions begin		
Teacher/27:25	"Necesítas decir por qué lo van a poner un éxis? Pero porqué?"	"You need to say why you're going to cross it off? But why?"	Teacher prompts students with more metacognitive questions.
Teacher/28:15	"Cuando tu grupo está listo, pon la mano. Me tienes que decir por qué."	"When your group is ready, raise your hand. You need to tell me why."	
Teacher/28:22	To one group: "Por qué pusieron un éxis aquí?"	To one group: "Why did you cross this one off?"	Prompts them to answer metacognitively, why did they do/think this.
Student/8:24	"Porque es"...(inaudible)	"Because it is"...(inaudible)	Students are able to say why they think the object does not belong
Teacher/28:50	Teacher gives the students stickers		Sticker appears to be a reward for completion of activity and explanation of why

In this scenario, it appears the teacher wanted the students to make significant cognitive advancements by not only determining which object does not belong in the pattern, but also being able to say why it does not belong. This type of thinking relates to metacognition because the students are being asked to explain why they thought this way. The partner talk the students engaged in, combined with the prompting metacognitive questions, allowed the students to

effectively answer the questions and complete the assignment. While it is not clear what the student's response was, since the teacher rewarded the two students with stickers, it appears they were able to successfully convey themselves metacognitively.

It is important to note that the teacher shifted from independent work to partner talk during the activity. While the students had been engaging in seemingly productive self-talk, repeating the phrase “cuál no vá” in order to more effectively think about the assignment, they were then switched to partner talk. Ideally, both of these types of talk would have been effective in getting the students to think metacognitively. It would have been interesting to see if the results would have been consistent if the students had been allowed to engage in self-talk in the same manner in which they were able to engage in partner talk. A map of the activity's progression will reveal how productive the use of both self-talk+ and teacher moves are in helping students think metacognitively (see Figure 5). As you can see, the teacher introduces partner talk, the students engage in partner talk, the teacher asks the students prompting questions to reach metacognition with one partner pair, and students are then capable of answering the metacognitive questions accurately.



*Figure 5.* Garden School, Kindergarten, Patterns.

**Example 3—Garden School, Kindergarten.** During this activity, students were placed into groups of four to five and asked to sort items in a basket into groups of similar attributes to analyze and compare shapes. The focus of the assignment was for students to work together, ideally engaging in exploratory talk, in order to decide together and justify why items were sorted into these groups. The teacher continuously circulated the room and gave her attention to several groups. She asked the groups questions that would prompt them to think metacognitively

about why they separated the objects into these groups and what attributes were represented in each of the groups (e.g. color, shape, size, etc.). Her interaction with one group, which showed some development of cognitive advancements through exploratory talk and teacher prompting towards metacognitive thinking, will be described below.

Speaker/Time (Video)	Discourse (Spanish/English)	English Translation	Self-talk+, Teacher Moves, Analysis
Teacher/31:46	“Estós son tús grupos? Por qué?”	“These are your groups? Why?”	Prompting to think metacognitively about why grouped in this way
Student 1/31:47	“Porque”...(inaudible)	“Because”...(inaudible)	Student responds to the question with reasoning
Teacher/31:49	“Y estás solamente...”	“And these ones by themselves...”	Prompting to think about the objects left out
Student 2/31:52	“No, no, no”...(inaudible) Student reaches to move the objects on the table	“No, no, no”...(inaudible) Student reaches to move the objects on the table	Potential for engaging in exploratory talk, reasoning with one another
Teacher/32:00	“Por qué vaya esté?”	“Why does this one belong?”	Prompting to think metacognitively about why they sorted that one in a certain way
Teacher/32:11	“Pero esté no es maripósas?”	“But, this one isn’t a butterfly?”	
32:13-32:28	Inaudible; Two students are looking around confused, not actively participating in the group		Exploratory talk is not working as effectively, potential for another type of self-talk+ to be used
Teacher/32:29	“Pero para mi está no va en este grupo. Por qué es qué? Mira escucha como dice por qué.”	“For me this one doesn’t belong in this group. Because why? Listen to how he says why.”	Encouraging the students to engage in this type of exploratory talk and explain to one another their reasoning behind their decisions
Student 2/32:37	“Porque solo son dos.”	“Because there are only two.”	

In this instance, the students are ideally reasoning with one another about the various methods of grouping the objects they were given. There is a wide variety of opportunities for the students to engage in exploratory talk, however at certain points in the conversation, see section 32:13-32:28, it does not appear that all the students are actively involved, even when the teacher is present. The teacher is asking questions that have the potential to get students to think metacognitively and result in a productive discussion. However, it appears that only portions of

the students are effectively engaging with the manipulatives and her questions. A map of this scenario will be displayed below (Figure 6A). As you can see, the map shows the teacher introducing group talk aimed at exploratory talk, the students engaging in group talk, the teacher asking one group of students prompting questions aimed at metacognition, and half of the students justifying their metacognitive reasoning while half are unable to make cognitive advancements.

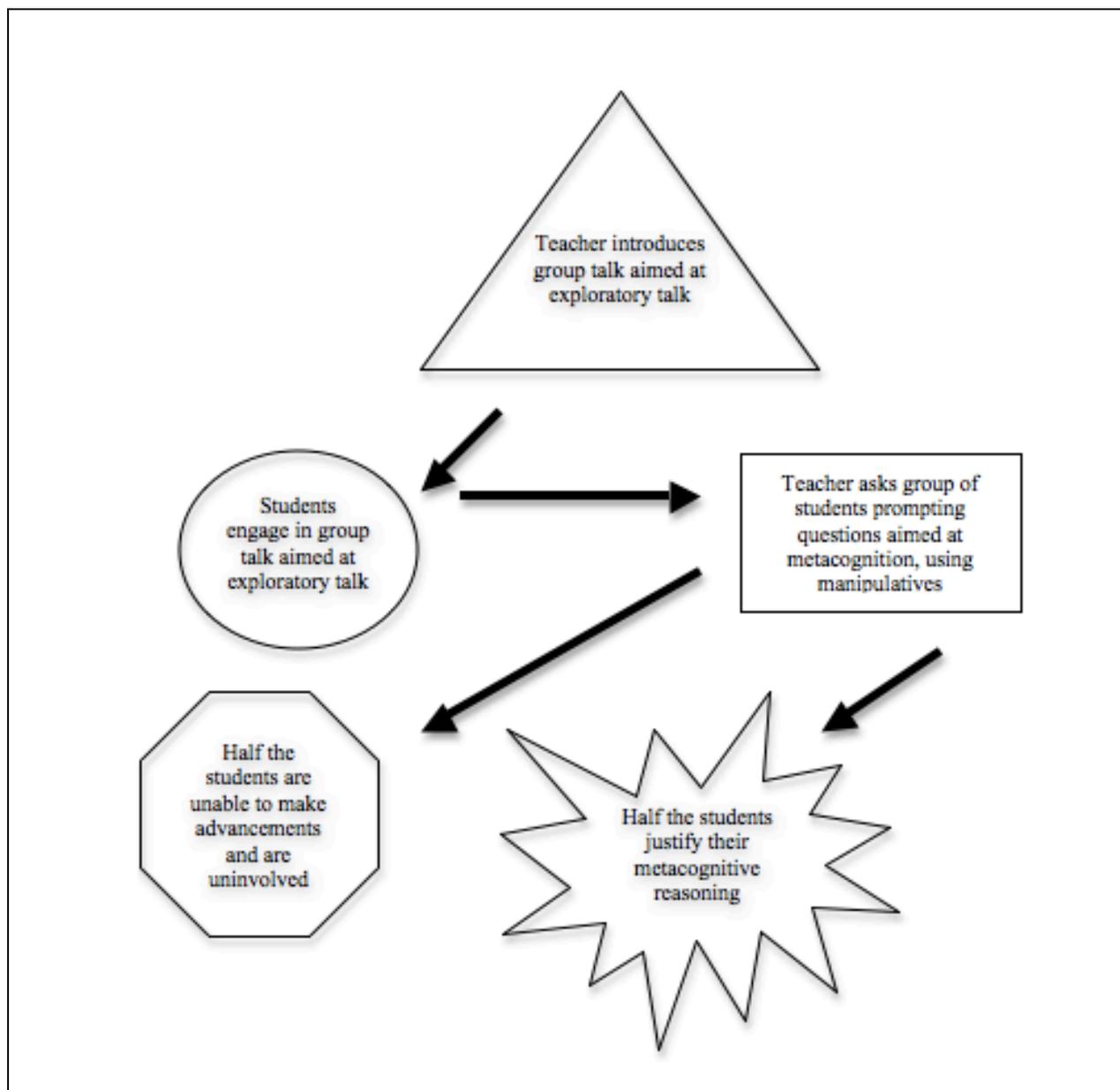
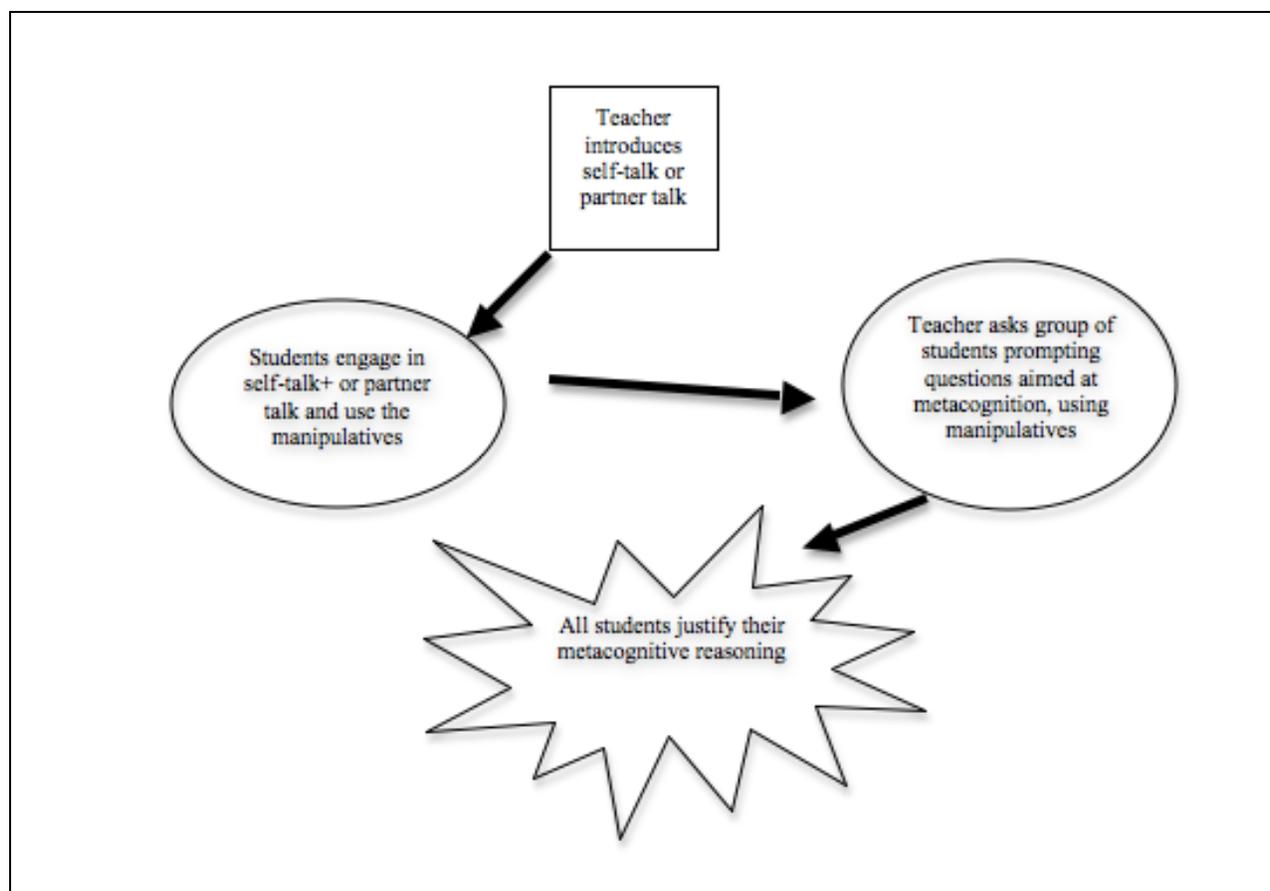


Figure 6A. Garden School Kindergarten, groups of similar attributes.

When considering the relationship of teacher moves and self-talk+, although not seen here, one could imagine that more strategic use of self-talk+ could further benefit the students. For example, imagine the teacher telling the students to either use their own manipulatives to make their individual conjectures, or write their thoughts down, or talk their own thought process through with themselves prior to sharing out with the rest of the group. Since the students were in a larger group setting, it was difficult for every student to have equal access to the manipulatives on the table and feel comfortable enough to share and debate their ideas with one another. Had the teacher introduced self-talk or partner talk, more students would have had the potential to make significant cognitive advancements. While it appears that some of the students were able to make cognitive advancements by justifying their metacognitive reasoning behind sorting the objects into groups, the entire group would have benefitted from more prompting to engage in productive exploratory talk. A map of the potential scenario will be displayed below (Figure 6B). This map shows the teacher introducing self-talk or partner talk, the students engaging in talk while using manipulatives, the teacher asking the student or group prompting questions aimed at metacognition, and all students justifying their metacognitive reasoning.



*Figure 6B.* Potential Garden School Kindergarten, groups of similar attributes.

**Summary of relationships across self-talk+, teacher moves, and cognitive advancement.** As previously noted, self-talk+ and strategic moves independently, each have the ability to help students make cognitive gains. However, it appears that self-talk+ and teacher moves combined have a greater potential of allowing students to make significant cognitive advancements, by movement through ZPD, increased understanding of a concept, or metacognition. However, if they are not combined strategically, students may not make these cognitive advancements in the way intended. As a result, if students are provided with the talk formats needed in addition to the support of strategic teachers' moves, they may have a greater potential of making cognitive advancements and succeeding academically.

## **Limitations**

There are some limitations to this study. The first limitation of this study is that it is small-scale, qualitative study. Although the data reviewed for initial analysis came from several dual language mathematics classrooms, only two teachers' classrooms were purposefully selected for full analysis. The two focus classrooms, kindergarten and fifth grade represent a wide span within elementary schools. Since the data sample is small, the results of the study cannot be generalized to classrooms that do not fit the same descriptions. In order to get more accurate, valid, and reliable data, more classrooms that fit the characteristics or have similar characteristics should be recorded and analyzed. However, the results may suggest possible practices in classrooms with similar characteristics, such as elementary mathematics classrooms and/or dual language mathematics classrooms at a secondary level.

The second limitation to this study is that data were taken from a larger study, which had overlapping themes with the research in this study, but was focused on whole group instruction. The data from the larger study were not gathered with the intentions of being analyzed for other types of talk in a smaller setting, such as group, partner, or self-talk. As a result, some of the more minute conversations that were analyzed in this study contain inaudible components or do not have complete follow through. To obtain more valid and reliable data, audio and video recordings of whole group, small group, and partner talk should be recorded and analyzed in order to focus on the themes (self-talk+, teacher moves, and cognitive advancement) in those particular areas.

If further research is done in this area, it is recommended that a larger sample be used to validate the results. This larger sample could entail more dual language elementary mathematics classrooms, dual language classrooms at the secondary level, and/or non-dual language

classrooms mathematics classrooms at the elementary and secondary levels. This larger sample size would allow us to determine if the purposes and results discussed above, relating to the relationship between self-talk+ and cognitive advancement, can be generalized to the larger education population.

## Chapter 5: Implications

The results of this study have several implications for students and teachers. First, this study showed that there are benefits to using self-talk or related forms in the classroom, specifically with the intentions of helping students make cognitive advancements. These findings suggest that students and teachers alike must recognize that there are benefits to talking aloud to oneself, especially in the classroom. In society, it seems there is a stigma against talking to oneself, but for some students, the time spent verbalizing their thoughts with themselves may be necessary for them to make cognitive advancements. While this may not always be a feasible practice in a classroom due to noise disruption or unavailable quiet spaces, other methods of talk (such as exploratory or partner talk) provide similar opportunities for students to have think time that may promote cognitive advancements. Teachers should consider implementing these methods of talk in their classrooms in order for students to engage in beneficial discussion with themselves or peers to enhance their learning.

Another implication for teachers is that they must hold their students to the high standards of the CCSSM. Recall, for example, when the East Brook kindergarteners were asked to answer metacognitive questions related to why they grouped certain objects together. Teachers must recognize the potential for student cognitive advancement that is achievable for every student despite acquisition of a new language or grade level. Sra. P prompted her students to think metacognitively, something admirable for kindergarteners, and especially students who are learning multiple languages. Students regardless of age have the potential of reaching metacognition and significantly reflecting on their own learning, a critical aspect of the CCSSM. Furthermore, regardless of ability in a particular language, dual language students or ELLs have the ability to meet the high standards of the CCSSM. Currently, overall, ELLs perform more

poorly than non-ELLs in mathematics (NCES, 2009). Perhaps if all students are held to these standards and allowed the opportunity to reach these standards in their preferred method, the benefits of speaking more than one language (e.g. greater cognitive flexibility, better problem solving, and use of higher order thinking skills) may support stronger math performance (Hukata, 1986; Marcos & Peyton, 2000).

Finally, teachers must provide students with various opportunities to discuss independently or with peers in a safe environment in order to make these significant cognitive advancements. They must create a classroom environment in which students are given access to various methods of talk and provided with the security of assistance. Recall, for example, when 5<sup>th</sup> grade students were confused regarding Sra. C's instructions. She came over to them and explained the directions, with the important addition of modeling, and helped the students understand the task. By maintaining a supportive tone, she helped the students and made them comfortable. A teacher may assist students in reaching metacognition or pursuing deeper knowledge of material by using talk moves to support higher levels of thinking. Nevertheless, students must be willing to learn in their own manner in order to achieve success and allow teachers to help them in achieving cognitive advancement. Recall, for example, when East Brook kindergarteners repeated Sra. P's instructions for drawing numbers independently in order to help themselves focus on the technical aspects of writing a number. By understanding their own needs, for example—if they need to talk aloud to themselves before whole group instruction, and allowing the teachers to support them with talk moves, students can take control of their own cognitive advancement.

## Chapter 6: Conclusions

The goal of this research was to uncover the purposes of self-talk+ in an academic setting. It also identified teacher moves associated with self-talk+. Finally, it determined how self-talk+ and teacher moves could be combined to achieve student cognitive advancement.

The research literature suggested ways in which self-talk could be used outside of the academic setting. This study expanded upon this research and determined the ways self-talk (and related forms) could be used in academic settings to help students make cognitive advancements. Strategic teacher moves were analyzed as well to determine ways in which teachers could help students in making academic gains in elementary mathematics classrooms.

The purposes of self-talk+ identified in this research include: ruminate on a difficult matter, increase understanding of a novel concept, redirect/restructure thought process, focus on technical aspects of a skill, and effectively engage with a task. The purposes were aligned with those from the literature review, but new research revealed that all of these purposes appear to aid students in making significant cognitive advancements. Modeling, prompting, and wait time are teacher moves to assist students' participation and understanding of material, as supported by the research literature and corroborated by this research. When associated with self-talk+, it appears that these teacher moves typically promote students' deeper engagement with academic material, advance them through their ZPD, or help them demonstrate metacognition. The data analysis found that when self-talk+ and strategic teacher moves are combined, the potential for student's cognitive advancement increases. In these classrooms, students were more likely to reflect upon their understanding of the material, demonstrate metacognition, or make cognitive advancements with the aid of self-talk+ and teacher moves.

While the results of this research suggest methods of reaching CCSSM standards in innovative ways in dual language elementary mathematics classrooms, there is the potential for more research related to the use of self-talk+ and strategic teacher moves in other classrooms. Further research can be done to determine how self-talk and the combination of self-talk+ and strategic teacher moves can be used throughout grade levels and across multiple subject areas. Research could also be done to determine how teachers and students would implement or use these types of talk and teacher moves in order for teachers to best adapt them to their own classrooms in the future.

### **Final Thoughts**

As a future special education teacher, I strive to find ways to engage my students with material in a way that makes sense to them and will help them make significant cognitive advancements. While reflecting back on the research project, I recall that while reviewing the audio and video recordings I first noticed the number of times students engaged in self-talk as a method of processing information, remembering information, and interpreting information in a new way. In many classrooms, the potential for this type of talk (individually paced and leveled) does not exist. Whether teachers reprimand students for talking out of turn or a student is made fun of for talking to him or herself, it does not seem that students have the option of reflecting on new or acquired knowledge in the manner that is best suited for them to make significant cognitive advancements. Self-talk+ individually, but especially when combined with strategic teacher moves, has the potential to aid students in making significant cognitive advancements when used in the classroom. In my own future classroom, I plan to attempt to implement self-talk, and related forms of talk, as a strategy a student can use to fulfill the purposes uncovered

through the research and simultaneously use prompting, modeling, and wait time to encourage students to make significant cognitive advancements.

## References

- Alanís, I. (2000). An analysis of a Texas dual language bilingual program and its effects on linguistic and academic achievement. *Bilingual Research Journal*, 24(3), 225–248.
- Askeland, M. (2012). Sound-based strategy training in multiplication. *European Journal Of Special Needs Education*, 27(2), 201-217. doi:10.1080/08856257.2012.669110
- Bee Tin, T. (2003). Does talking with peers help learning? The role of expertise and talk in convergent group discussion tasks. *Journal Of English For Academic Purposes*, 2(1), 53. doi:10.1016/S1475-1585(02)00033-4
- Callicott, K. J., & Park, H. (2003). Effects of self-talk on academic engagement and academic responding. *Behavioral Disorders*, 29(1), 48-64.
- Cazden, C. B. (2001). *Classroom discourse: The language of teaching and learning* (2<sup>nd</sup> ed.). Portsmouth: Heinemann.
- Chapin, S., O’Conner, C., & Anderson, N. (2009). *Classroom Discussions* (2<sup>nd</sup> ed.). Sausalito, CA: Math Solutions.
- Council of Chief State School Officers and the English Language Proficiency Development Framework Committee in collaboration with the Council of Great City Schools, the Understanding Language Initiative at Stanford University, and World-Class Instructional Design and Assessment (2012). *Framework for English language proficiency development standards corresponding to the Common Core State Standards and the next generation science standards*. Retrieved from [http://www.ccsso.org/Resources/Publications/The\\_Common\\_Core\\_and\\_English\\_Language\\_Learners.html](http://www.ccsso.org/Resources/Publications/The_Common_Core_and_English_Language_Learners.html)

Council of Chief State School Officers (CCSSO) & National Governors Association Center for Best Practices (NGA Center) (2010). *What parents should know*. Retrieved from <http://www.corestandards.org/what-parents-should-know/>

Council of Chief State School Officers (CCSSO), & National Governors Association Center for Best Practices (NGA Center). (2010). *Common Core State Standards for mathematics*.

Flavell, J. H. (1981). Monitoring social and cognitive enterprises: something else that may develop in the area of social cognition. In J. H. Flavell & L. Ross (Eds.), *Social cognitive development: Frontiers and possible futures* (pp. 272-287). Cambridge; New York: Cambridge University Press.

Glenn, S. M., & Cunningham, C. C. (2000). Parents' reports of young people with Down syndrome talking out loud to themselves. *Mental Retardation*, 38(6), 498-505.  
doi:10.1352/0047-6765(2000)038<0498:PROYPW>2.0.CO;2

Hakuta, K. (1986). *The mirror of language: The debate on bilingualism*. New York: Basic Books.

Kolovelonis, A., Goudas, M., & Dermitzaki, I. (2012). The effects of self-talk and goal setting on self-regulation of learning a new motor skill in physical education. *International Journal Of Sport And Exercise Psychology*, 10(3), 221-235. doi:10.1080/1612197X.2012.671592

Lindholm-Leary, K. J. (2001). *Dual language education*. Clevedon, England: Multilingual Matters.

Livingstone, J.A. (1997) *Metacognition an overview*. Retrieved from <http://gse.buffalo.edu/fas/shuell/cep564/metacog.htm>

Manning, B. H. (1990). A categorical analysis of children's self-talk during independent school assignments. *Journal Of Instructional Psychology*, 17(4), 208-217.

- Marcos, K.M., & Peyton, J.P. (2000). Promoting a language proficient society: What can you do. *Learning Languages*, 7(2), 4-7.
- Moschkovich, J. (2002). A situated and sociocultural perspective on bilingual mathematics learners. *Mathematical Thinking and Learning*, 4(2 & 3), 189-212.
- Moschkovich, J. (2007). Using two languages when learning mathematics. *Educational Studies in Mathematics*, 64, 121-144. National Center for Education Statistics (2009). *The condition of education 2009*. Retrieved from <http://nces.ed.gov/pubs2009/2009081.pdf>
- National Center for Education Statistics (2012). *The Nation's Report Card: Mathematics 2011*. (NCES 2012-458). Washington, D. C.: U. S. Department of Education.
- National Clearinghouse for English Language Acquisition. (2011). *The growing number of English learner students*. Retrieved from <http://www.ncele.gwu.edu/publications>
- Rajala, A., Hilppo, J., & Lipponen, L. (2012). The emergence of inclusive exploratory talk in primary students' peer interaction. *International Journal Of Educational Research*, (53), 55-67.
- Simonsen, B. (2013). *Teaching and Assessing Functional Academics*. Personal Collection of Brandi Simonsen, University of Connecticut, Storrs, Connecticut.
- Strauss, A. L., & Corbin, J. M. (1990). *Basics of qualitative research: Grounded theory procedures and techniques*. Newbury Park, Calif.: Sage Publications.
- Theodorakis, Y., Weinberg, R., Natsis, P., Douma, I., & Kazakas, P. (2000). The effects of motivational and instructional self- talk on improving motor performance. *The Sport Psychologist* 14, 253–271.

- Thomas, W., & Collier, V. (2002). A national study of school effectiveness for language minority students' long-term academic achievement. Santa Cruz, CA: Center for Research on Education, Diversity & Excellence.
- Thorius, K., & Sullivan, A. L. (2013). Interrogating instruction and intervention in RTI research with students identified as English language learners. *Reading & Writing Quarterly*, 29(1), 64-88. doi:10.1080/10573569.2013.741953
- Truxaw, M.P. (2014, April). *Lessons learned from linguistically diverse mathematics classrooms*. Paper presented at the 2014 Annual Meeting of the American Educational Research Association, Philadelphia, PA.
- U.S. Census Bureau. (2013). Language use in the United States: 2011. *American Community Survey Reports*. Retrieved from <http://www.census.gov/prod/2013pubs/acs-22.pdf>
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes* (M. Cole, V. John-Steiner, S. Scribner, & E. Souberman, Eds.). Cambridge, MA: Harvard University Press.
- Vygotsky, L. S. (2002). *Thought and language* (13<sup>th</sup> ed.). Cambridge, Massachusetts: MIT Press.