VISUALIZING FROM WITHIN: A NATURALISTIC INQUIRY ON THE IMPLEMENTATION OF MINDSKETCHING TO BUILD THE ACADEMIC LITERACY OF CHILDREN RAISED IN POVERTY

A Dissertation

by

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ABSTRACT

Literature has consistently documented that children raised in poverty struggle to achieve academic success, in part, because they often enter school with low academic literacy. Academic literacy is usually defined as the language used in schools to communicate or acquire knowledge. The purpose of this study was to examine seven elementary school teachers' observations, insights, and perceptions of a visualization strategy called *mindsketching*. Mindsketching was used to build academic literacy of their students, the majority of whom came from low-income backgrounds. Through naturalistic inquiry, data were obtained from face-to-face interviews and classroom observations. The constant comparative method and thematic analysis were used to analyze the data for emergent themes.

The results of the study included the following: first, teachers observed that an in-depth understanding of mindsketching was necessary for purposeful implementation. Teacher use evolved over the years−from introductory activities or games to a teaching tool used for various instructional practices. Second, mindsketching encouraged metacognition in their students. As a result, teachers' communication with students, such as instructions, explanations, and affirmations, took on a metacognitive bent. Third, mindsketching as a visualization strategy, provided the initial step towards engaging students in effective learning. In conclusion, mindsketching supported students in visually bridging images to words, thereby enhancing learning.

DEDICATION

To Amma and Pappa, Mrs. Florence Leela Raj and the late Mr. D. V. Tharmaraj,

for instilling in me the quest for knowledge…

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CHAPTER I

INTRODUCTION

Imagine an elementary school where the majority of the students are raised in poverty. These students experience consistently failing grades and, ultimately, many drop out of school. Very few would argue that this is not an ideal situation. Most school leaders would work with fervor to reverse this phenomenon if it were present in their schools.

Despite persistent efforts, schools are greatly concerned with issues of poverty, due to the negative impact of poverty on academic achievement. Over the years, research on children from poverty indicates that these students enter school with a weak literacy foundation. Specifically, they have less advanced language skills than do children from non-poverty families in terms of vocabulary size, reading achievement, and oral language (Barone, 2006; Fernald, Marchman, & Weider, 2013; Hart & Risley, 1995; McLoyd, 1998; White, 1982). Research studies also support the notion that children raised in poverty often experience low achievement in school (Becker & Luthar, 2007; Hopson & Lee, 2011; Smith, Brooks-Gunn, & Klebanov, 1997).

This study looked at how teachers helped their students achieve academic success in their elementary school classrooms using a visualization strategy called *mindsketching* (Juntune, 1987; Juntune, 2012; Juntune, Kaya, & Ramos, 2011) Using a naturalistic approach distilled from the teachers' experiences, the study focused on how they used this strategy to build academic literacy of their students−the majority of whom were raised in poverty.

Essentially, what does *poverty* mean? In the United States, poverty is defined according to income and family size. For example, the poverty level for 2013 was set at a gross income of $23, 624 for a family of four (Yang, Ekono & Skinner, 2015). The Federal Poverty Line (FPL), the most widely used poverty measure in the United States, generally refers to the cost of minimal basic necessities−food, clothing, shelter, and transportation−that are adjusted for inflation. (Anthony, King, & Austin, 2011). In the United States, living in poverty is often associated with low socioeconomic status (SES) as the most commonly used proxy of SES is a measure of earned income (Braveman, Cubbin, Marchi, Egerter, & Chavez, 2001).

Within school settings, the typical indicator used to measure overall poverty is the percentage of students who are eligible for free or reduced-price lunch (FRPL) programs (Harwell & LeBeau, 2010). FRPL is widely used to measure school poverty as there is a strong correlation with district-wide poverty level, while at the student level, FRPL correlates with SES measures reported at the student or household level (Aud, 2011).

As a result, a high-poverty school consists of more than 75% of the student population eligible for FRPL while a low-poverty school consists of 0% to 25% of the student population rated eligible for FRPL (Aud et al., 2011). Using these guidelines, 19% of public elementary schools in the United States were considered high-poverty schools in 2008 and 2009 (Aud et al., 2011).

Statement of the Problem

Schools struggle to help students from poverty achieve academic success. There is a substantial body of research linking poverty to academic underachievement (Duncan & Brooks-Gunn, 1997; Hopson & Lee, 2011; McLoyd, 1998; White, 1982). This study corroborated a review of literature drawn from research in the psychological and behavioral sciences in the area of academic literacy (Morrison, Bachman, & Connor, 2005).

Academic literacy refers to formalized language used in educational settings such as schools or colleges (Johnson, 2009). The language used in academic literacy is unlike social language, which is used in everyday conversation (Snow, 2010). The general conclusion is that children exposed to poverty during early childhood are more likely to experience impeded language and academic literacy (Coleman et al., 1966; Duncan & Brooks-Gunn, 1997; Hart & Risely, 1995; McLoyd, 1998; Sirin, 2005; White, 1982).

One strategy to help build academic literacy is the use of visualization to comprehend and learn text materials (Dunlosky, Rawson, Marsh, Nathan, & Willingham, 2013). One of the most well-known theories underlying visualization is Allan Paivio's (1969; 1978) dual coding theory, in which he argues that images enhance memory for verbal or written information due to the interplay between two independent cognitive systems–one devoted to verbal information or language and the other devoted to image-based information. The implication of his theory is that visuals promote information processing, and therefore, learning.

The majority of studies on the use of visualization in school curriculum focuses on the use of drawing strategies by students to either learn the content of a particular topic or to reflect their understanding of a topic (e.g. Alesandrini, 1981; Baghban, 2007; Paquette, Fello, & Jalongo, 2007; Van Meter, Aleksic, Schwartz, & Gardner, 2006). These strategies entail the use of elaborate details to enhance learning. The purpose of these visualization techniques is to help students achieve academic success. Most studies on visualization as an instructional technique are based heavily on language-arts subjects such as reading and writing.

The role of visualization to help build academic literacy of students raised in poverty has received scant attention. This study addresses three gaps in the literature. First, there is a dearth of information on how teachers utilize visualization techniques to build academic literacy. For decades, researchers have studied the role of visual images in promoting children's literacy (e.g. Dyson, 1983; 1986; Kendrick & McKay, 2004). Although there are studies that mention the use of images to enhance literacy, there are few studies on the specific use of visualization to build academic literacy. Further, there are no studies detailing the use of visualization to build academic literacy of students raised in poverty. Second, this study focuses on sketching images to enhance learning instead of using elaborate drawing techniques. The specific technique explored in this study is mindsketching. There are no studies to date that detail the uses of mindsketching to build academic literacy. Third, this study focuses on the use of sketching to build academic literacy of students raised in poverty in a variety of content areas beyond the language arts, including math, science, and social studies.

Statement of the Purpose

The purpose of this study was to advance the scientific literature on building academic literacy by focusing on a particular population–children raised in poverty. This study described the observations, insights, and perceptions of teachers who used mindsketching as an attempt to build the academic literacy in their students from poverty. While information acquired from this study may be useful for other populations in other settings, generalization was not the objective; rather, the intent was to conduct a qualitative study examining teachers' experiences of, and recommendations for, building the academic literacy of their students from poverty.

To understand the problem within the context of poverty, qualitative methodology, specifically naturalistic inquiry, was used to study a group of teachers from low-SES schools in Texas. The study examined how the teachers used mindsketching strategies in the elementary school classroom and described the changes they observed in their students after initiating the use of mindsketching. Specifically, this naturalistic inquiry focused on elementary school teachers who were trained in mindsketching and had been incorporating mindsketching into their teaching for at least two years. These teachers' stories illuminated the complexities of their experiences and beliefs relating to the use of mindsketching.

In addition, the naturalistic inquiry approach allowed the researcher to build a "thick description" (Geertz, 1973) of the process under study and then to analyze the data collected for emergent themes. The primary quest, therefore, was to understand the

phenomenon of interest from the participant's or insider's perspectives (the emic) rather than the researcher's or outsider's perspective (the etic) (Merriam, 1998).

Research Questions

The overarching research question for this study was: How did teachers use mindsketching techniques to build academic literacy of their students raised in poverty? To answer this overarching question, three specific research questions were developed to guide the study:

1. What do teachers understand about the purpose of mindsketching?
2. How do teachers use mindsketching in the classroom setting?
3. What are the changes that teachers have observed in their students since initiating the use of mindsketching?

Limitations of the Study

The goal of a qualitative study is to provide a thick description of a phenomenon and from that, transferability. Although generalizability of the findings was not the purpose of this study, the information gathered may be useful for teachers in a similar setting. Several limitations to this study were:

1. The study was limited to selected teachers who had used mindsketching to build academic literacy in their students raised in poverty.
2. The information gathered was based on a small purposeful sample limited to one school district in a single geographical location.
3. The study was limited to the information gathered from the literature review, and researcher observations.

4. The study was limited to the data generated from semi-structured interviews and classroom observations.

Dissertation Design

The results of this study are structured into five distinct chapters. The first chapter introduces the focus of the study and presents the background and research questions related to the study. Chapter II is dedicated to a review of related literature upon which this study is based. Chapter III details the methodology of this study and includes a description of the participants and setting, the data collection procedures, and methods for analyzing the data. Chapter IV summarizes the findings of this study. Chapter V presents a discussion of the research findings. This final chapter additionally offers recommendations for practice and future research.

CHAPTER II

REVIEW OF RELATED LITERATURE

The purpose of this literature review is to examine several theoretical strands of research that provided the foundation of this study: namely on poverty, academic literacy, intelligence, and visualization (including memory and cognitive load). The confluence of these concepts provides a contextual lens for a study on the experiences of teachers who used mindsketching to build academic literacy in students raised in poverty.

The Complexities of Poverty

Before embarking on examining the foundational concepts of this study, it is meaningful to explore the term *poverty* In the United States, poverty is defined according to income and family size. The poverty level for 2013 was set at a gross income of $23, 624 for a family of four (Yang et al., 2015). The Federal Poverty Line (FPL) is the most widely used poverty measure in the United States (Anthony et al., 2011) and these costs are adjusted for inflation. The FPL was established in the 1960s to represent the cost of minimal basic necessities−food, clothing, shelter, and transportation. Government administrations regularly adopt poverty guidelines to determine eligibility for public assistance programs and policy makers commonly adopt FPL to estimate the number of people living in poverty in the United States.

As the FPL was developed in the 1960s, it has widely been seen as an inadequate measure of poverty (Blank, 2008; Couch & Pirog, 2010). It has also been criticized for computing the poverty threshold based on assumptions taken from 1955 consumption

data (Anthony et al., 2011). Further, poverty measures have come under fire for being outdated, narrowly-focused on local communities, and not location-specific (Kolesnikova & Liu, 2012). In short, methods for measuring poverty are inadequate and therefore, do not provide an accurate picture of the number of low-income families and individuals (Anthony et al., 2011).

From an educational standpoint, the National Assessment of Education Progress (NAEP) reviewed scores from both high- and low-poverty schools for a variety of educational outcomes. Based on data collected from reading assessments administered from 1998 to 2009, students in the fourth and eighth grades from high-poverty schools received significantly lower scores than students from low-poverty schools; high-poverty schools also saw a lower percentage of 12th-grade students graduating with a high school diploma or attending college (Hemphill & Vanneman, 2011). Moreover, students who participated in FRPL programs were likely to perform poorly in reading and mathematics (Okpala, Smith, Jones, & Ellis, 2000) as well as on standardized tests (Caldas & Bankston III, 1997).

Layered in with poverty's other various complexities, research has suggested that generational poverty (defined as at least two consecutive generations born into poverty), as opposed to situational poverty (temporary economic hardships that tend to be of short duration), can have even more enduring negative effects on children (Duncan, Brooks-Gunn, & Klebanov, 1994; Jensen, 2009; McLoyd, 1998). The length and severity of poverty exposure have been found to be more damaging to children's outcomes than the

familial poverty level at any single point in time (Duncan et al., 1994; Magnuson & Duncan, 2006; Wagmiller, Lennon, Kuang, Alberti, & Aber, 2006).

Many educators are familiar with Payne's (2005) work on poverty because it is frequently used in professional development workshops (Bomer, Dworin, May, & Semingson, 2008). Payne (2005) emphasized the importance of teaching children living in poverty to recognize the hidden rules of the middle class, thus improving their chances of social mobility. Payne's (2005) work is highly popular in the U.S. educational landscape due to her advocacy on issues of poverty and education (Bohn, 2007; Ng & Rury, 2006).

However, heavy criticism of Payne's work also abound. Her research, built on a deficit thinking perspective, has been described as elitist, classist, and racist (Gorski, 2008; 2007). Others consider her work as not grounded in scholarly research or using real data (Bohn, 2007; Ng & Rury, 2006). Yet another group argues that her research oversimplifies the complexities of poverty, resulting in teachers becoming misinformed (Bomer et al., 2008; Howley, Howley, & Huber, 2005). Payne's work is based heavily on her own personal experience of being married to a man who grew up in extreme poverty (Tough, 2007). Bomer and colleagues (2008) contend that the primary issue with her work is that instead of writing her experiences as a rich narrative text, she writes as if her assertions are based on research data.

Indeed, poverty presents an enduring generator of stress for families and children that may impede child development and school achievement (McLoyd & Wilson, 1990). Since families constitute the primary providers of basic necessities, education, and the

transmission of values (Engle & Black, 2008), children born into poverty-ridden families are exposed to what Parker, Greer, and Zuckerman (1988) term *double jeopardy*. This means that firstly, children raised in poverty are exposed to risks associated with families living in poverty such as limited resources, stress, and lack of role models of healthy socio-emotional functioning. Secondly, children from poverty face more severe consequences from their home environments, such as poor educational outcomes in school, due to their adverse developmental outcomes. For example, Brooks-Gunn and Duncan (1997) found that children from poverty were twice as likely to be at risk for grade repetition and dropping out of high school than children from non-poverty backgrounds.

When discussing issues of academic achievement and children living in poverty, two essential factors are academic literacy and intelligence (Gottfredson, 2004; Neisser et al., 1996; Wamba, 2010). The next section in this review deals with literature pertaining to the description of academic literacy and academic literacy within the context of poverty.

Academic Literacy

There is no formal definition of the umbrella term *literacy*. The term is multi-faceted due to its roots in various social, political, and cultural contexts (Hagel & Tudge, 1998; Hillerich, 1976; Ntiri, 2009; Slaughter-Defoe & Richards, 1995). However, most studies agree that literacy entails competence in both oral (listening and speaking) and written language (reading and writing) (van Kleeck, 2007). Literacy is also the essential

bedrock for acquisition of procedural and declarative knowledge across domains in both school and life activities.

Literacy includes related terms such as *academic literacy*, *academic language*, *academic vocabulary*, and *academic language skills* (Baumann & Graves, 2010). This study uses the term *academic literacy* to refer to language used in school settings (Bowers, Fitts, Quirk, & Jung, 2010). Academic literacy is also defined as "the kind of literacy needed for achievement on traditional school tasks and standardized assessments" (Lewis & Reader, 2009, p. 105). In discussing issues of academic literacy, the term *academic language* appears frequently in the literature. Academic language is part of academic literacy as it requires linguistic registers that students are expected to use within the context of their schooling (Ehlers-Zavala, 2008). Academic language is used in various aspects of the academic realm such as in content-area curricula, explicit instructions, and classroom textbooks (Johnson, 2009).

Academic language is markedly different from the social language students use in everyday conversations (Snow, 2010). In ordinary spoken language, the speakers involved can be imprecise, with either short responses or lengthy sentences. Context and nonverbal cues help facilitate meanings and expressions (Wong-Fillmore, 2004). However, academic literacy, as a part of various school literacy tasks, often involves decontextualized language or language that is devoid of interpersonal cues. The language used tends to be concise with complex ideas compressed into fewer words and long sentences consisting of sequenced of information (Snow, 2010; Snow & Uccelli, 2009).

Academic literacy encompasses two main types of vocabulary. The first is domain-specific academic vocabulary found in explicit content areas such as *dew point* and *pressure* in science or *bisect* and *scalene triangle* in math (Marzano & Pickering, 2005). The second is general academic vocabulary consisting of words that cross multiple content areas such as *similar*, *chart*, *cycle*, and *transport* (Coxhead, 2000). Together, these comprise examples of academic vocabulary commonly used in classrooms.

Another way to understand academic literacy is that it is analogous to what are termed *bricks* and *mortar* by Dutro and Moran (2003). Brick terms such as domain-specific academic vocabulary are content-specific. These terms extend from *concrete bricks* such as places, events, and illustratable processes, to *abstract bricks* which are more complex and philosophical, such as *photosynthesis* and *democracy*. On the other hand, mortar words and phrases are general-utility words that hold these bricks together. They consist of words from a variety of domains that hold the content-specific technical words together. Mortar words communicate complex thoughts; examples include *dimension*, *require*, *represent*, and *correspond*. Mortar words can also include 1) words expressing connectives, such as *therefore*, *because*, and *however*; 2) prepositions such as *behind*, *without*, and *between*, and 3) pronouns, such as *it*, *each other*, and *themselve*s. Such mortar words are crucial to the creation of logical and coherent sentences and paragraphs.

Yet another critical group of mortar words found in academic settings−namely in school tasks, tests, and texts−is vocabulary needed to describe higher-order thinking

skills (Scarcella, 2003). Examples include *analyze*, *establish*, *consequences*, and *link*. These words are found across a wide spectrum of academic subjects and according to Scarcella (2003) are often untaught despite being fundamental to threading complex ideas together.

Academic literacy serves three main functions to describe: 1) complexity; 2) higher-order thinking, and 3) abstraction (Zwiers, 2008). Firstly, one of the main functions of academic literacy is to describe and explain complex concepts in any discipline in a clear and concise manner (Schleppegrell, 2004). All content areas in school encompass complex ideas and relationships. For example, in math there are complex ways to solve word problems, in language arts there are complex plots to interpret (Zwiers, 2008).

Secondly, academic literacy comprises language used in school to describe complex thinking processes or higher-order thinking skills. Higher-order thinking skills are cognitive processes used in academic language to comprehend and express ideas, as well as to solve problems (Facione, 1990; Swartz, 2001). One of the best known models for organizing thinking skills is Bloom's Taxonomy of the Cognitive Domain (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956). Bloom and his colleagues classified learning objectives, from less to more complex, as follows: knowledge, comprehension, application, analysis, synthesis, and evaluation. In the 1990s, the taxonomy was updated to reflect the current understanding of cognitive processes; consequently the hierarchy of thinking processes now consists of remembering, understanding, applying, analyzing, evaluating, and creating (Anderson & Krathwohl, 2001). Other researchers contend that

classrooms use academic language for other cognitive functions such as classifying, comparing, and hypothesizing (Valdez-Pierce & O'Malley, 1992; Wiggins & McTighe, 1998).

With regards to higher-order thinking skills, students need to be engaged in metacognition to be capable thinkers. Johnson (2009, p. 52) provides a working definition of metacognition−"thinking about our thinking"−which involves students being critically aware of their own thinking and learning and monitoring their own strengths and weaknesses as learners. When students are involved in metacognitive practices, they are able to transfer their learning to novel contexts and tasks (Palincsar & Brown, 1984). Effective strategies for metacognitive monitoring include noticing when meaning breaks down, keeping track of meaning, and applying specific strategies to maintain and promote further understanding (Harvey & Goudvis, 2007). Therefore, the goal of metacognition is to become a self-directed learner (Ambrose, Bridges, Lovett, DiPietro, & Norman, 2010).

The third function of academic language is to describe abstractions found in any content area (Zwiers, 2008). Abstractions are concepts or ideas that have two key characteristics. First, they represent a reduction in information as compared to a concrete idea. Second, abstractions are general principles that are consistent across different concrete ideas or situations (Garlick, 2010). Examples of abstractions include numbers, words like *half*, *diffusion*, and *liberty*, and phrases such as *similarities between two cultures*, *evidence that supports the opposing position*, and *interpretations of a character's actions* (Garlick, 2010; Zwiers, 2008).

Students often face challenges in coping with academic literacy, even at the elementary levels (Christie, 1998; Fang, Schleppegrell, & Cox, 2006; Schleppegrell, 2004). In kindergarten and the early elementary grades, a student is often expected to describe an object or narrate an account of a certain past event (Christie, 1985; Michaels & Cazden, 1986). In addition, the use of stories is a dominant staple in the early elementary grades. Students may have difficulties dealing with language that is elaborate and densely structured. One example can be seen in a well-known fable "The Cat and the Mice," generally used as a primary grade storybook (Percy, 2002). Certain students have found the language used in the following sentence to be problematic: *A large, prowling ginger cat made every day a perfect misery for the mice* (Fang et al., 2006, p. 13).

Much of the research on academic literacy has focused on children who are second-language learners of English, commonly known as English Language Learners (ELLs) (Snow & Uccelli, 2009). These authors noted that the challenges of academic literacy faced by native speakers tend to receive inadequate attention. In fact, conceptualization of academic literacy as a means of guiding educators is a topic conspicuously absent from most handbooks on educational linguistics (Spolsky & Hult, 2007). As was noted in Chapter I, there is a substantial body of research linking poverty to academic underachievement (Duncan & Brooks-Gunn, 1997; Hopson & Lee, 2011; McLoyd, 1998; White, 1982) but a thorough search through several popular databases on education (ERIC, PsycINFO, and Academic Search Premier) revealed a dearth of

research literature specific to the challenges of academic literacy faced by students living in poverty.

Adding to an additional complexity to academic language in academic literacy, studies have also indicated that certain groups of low-SES children (such as African-American children) have distinctive linguistic strengths not captured by mainstream tests and procedures, such as elaborate improvisational rhymes and use of poetic devices in narratives (Gilmore, 1986; Heath, 1983). These studies also assert that the children in question do not appear linguistically deficient within their own groups, but tend to look deficient when viewed from the aspect of mainstream expectations. These expectations may vary from culture to culture and are shaped by the cultural expectations of teachers (Moltó, Florian, Rouse, & Stough, 2010). However, Hoff (2013) counters that low-SES children, regardless their ethnic group, score poorly on many measures that predict academic achievement. The implication is that efforts to build the complex language used in school continue to be crucial for academic success.

Academic literacy is one of the key factors affecting the achievement gap between high- and low-performing groups (Wong-Fillmore, 2004). Students who underperform often come from backgrounds that have not prepared them for mainstream schooling's ways of speaking, reading, and thinking. Students in poverty often lack exposure to academic literacy and the types of language used in school because they have less academic support and fewer school-like conversations in their home environments (Zwiers, 2008).

Academic Literacy within the Context of Poverty

For several decades, researchers have studied the impact of poverty on academic achievement (see Coleman et al., 1966, Duncan & Brooks-Gunn, 1997; Hopson & Lee, 2011). White (1982) conducted the first meta-analytic study in this area, focusing on articles published before 1980. Sirin (2005) replicated White's (1982) study by focusing on articles published between 1990 and 2000. Both reviews conclude that there was a lack of academic readiness in children from poverty, leading directly to their academic underachievement.

Children in poverty demonstrate a number of academic deficits. They possess a weaker grasp of language skills when they begin school, as compared to children from higher SES backgrounds (Alexander, Entwisle, Blyth, & McAdoo, 1988; Entwisle & Alexander, 1996). In particular, when compared to their middle- to high-SES counterparts, children from lower SES families perform significantly poorer in oral language and vocabulary growth (Dollaghan et al., 1999; Hart & Risley, 1995; Reynolds & Fish, 2010), grammar (Dollaghan et al., 1999), phonological awareness (Burt, Holm, & Dodd, 1999), and narrative skills (Myers & Botting, 2008; Norris & Bruning, 1988; Shiro, 2003).

Academic deficits exhibited by children from poverty also impact other content areas. Research has consistently demonstrated that students' reading achievement scores on first-grade assessments are highly correlated with math test scores throughout their school careers (Arnold & Doctoroff, 2003; Crawford, Tindal, & Steiber, 2001; Duncan et al., 2007). Studies have also shown that although lower SES children do not tend to

differ from higher SES children in their performance of math calculations, lower SES children do exhibit poorer performances with regards to the word problems commonly found on math achievement tests (Jordan, Huttenlocher, & Levine, 1992). These studies indicate that children from low-SES families are at risk of poor performance along a spectrum of content areas in the current curriculum.

Children from poverty and vocabulary acquisition. Hoff (2013) stated that in the area of vocabulary size, lower SES children possess less advanced language skills than higher SES children. Tough (1982) found that lower SES children with limited vocabulary used it less frequently for tasks requiring analysis and reason, justification and reflection, and when predicting and considering different alternatives; all of these are higher-order skills necessary for academic literacy.

Parents are the primary caregivers and role models to their children. Evidence suggests that maternal education is one of the key factors to influencing child language development, a crucial component in building academic success (Adams & Ramey, 1980; Dollaghan et al., 1999). Dollaghan and colleagues (1999) noted that children of mothers who did not graduate from high school scored the lowest in language outcomes (such as number of different words, total number of words, and vocabulary) compared to mothers who had a college degree and mothers who graduated from high school. Children from low-SES backgrounds who also have mothers with low levels of education are not exposed to conversation-rich environments.

Hart and Risley's (1995) landmark study pointed out a significant effect of poverty on vocabulary growth; the gap between the number of words produced by

children from higher and lower SES levels increased over time. These researchers found that by the age of three, children from high-SES backgrounds had an average vocabulary of 1,116 words while children from working class families averaged 749 words. However, children from low-SES backgrounds had vocabulary that averaged 525 words. Specifically, these researchers predicted that by the age of three years, children from the high-SES homes in their sample had heard nearly 40 million words while children from the low-SES families had heard only 10 million words. Hart and Risley (1995) also found that the higher SES children not only had heard more total words from their families than did lower SES children, but higher SES children had also heard more different words as a result of the diverse vocabulary employed by speakers in their homes.

A more recent study (Reynolds & Fish, 2010) noted a similar trend. The language skills of low-SES children from rural Appalachia substantially declined when they entered kindergarten, even though at 15 months they corresponded with children from higher SES backgrounds. These studies show that children from low-SES backgrounds consistently possess limited vocabulary as compared to children from higher SES backgrounds.

Children from poverty and reading acquisition. In terms of reading skills evidence from research suggests that children from poverty perform below average on pre-literacy skills, including phonological awareness (the ability to isolate and manipulate sounds) and print awareness and letter knowledge (the knowledge of forms and functions of print) (Barone, 2006; Dodd & Carr, 2003; Justice & Ezell, 2004).

These pre-literacy skills play an essential role in children's early reading success (National Institute for Literacy, 2008; Snow, Burns, & Griffin, 1998).

The role of maternal education in the development of a child's vocabulary growth has been discussed. In a study on reading practices, Williams (1999) found that unlike mothers from low-SES backgrounds, mothers from higher SES backgrounds frequently asked their children to elaborate on parts of books, connect what they read to their own experiences, and evaluate stories using open-ended questions. High-SES mothers (who tend to be more educated) read to their children often, and consequently, books abound in their homes; they create for their children a stimulating and literate environment (Davis-Kean, 2005). Williams (1999) noted that these types of reading interactions in higher SES families resembled those found in literacy and assessment practices in school settings.

Similarly, in one book-reading task, mothers in higher SES families produced more speech per unit of time. The speech adopted in their parent-child interactions during the task was structurally more complex and centered on conversations about language itself (Hoff-Ginsberg, 1991; Weizman & Snow, 2001). The book-reading setting seemed to exert a powerful shaping effect on the nature of maternal speech: in this study, it increased lower SES mothers' complexity of language to the level of higher SES mothers (Hoff, 2006; Hoff-Ginsberg, 1991).

A lack of academic literacy also directly affects reading comprehension (Johnson, 2009). Academic literacy, academic comprehension, and academic learning share a mutually supportive tripartite relationship known as the *Mathew Effect*

(Stanovich, 1993). The Mathew Effect is based on the parable of Jesus in the book of Mathew: *for whoever has, to him more will be given, and he will have abundance; but whoever does not have, even what he has will be taken away from him* (Mathew 13:12, New King James Version). In essence, the Mathew Effect explains that students who possess a large academic vocabulary are able to comprehend more successfully and, in turn, this ability to comprehend boosts their learning of new academic language. On the other hand, the Mathew Effect can also be seen when students from poverty struggle to read. They develop less vocabulary, and that smaller vocabulary makes it arduous to comprehend what they read.

Children from poverty and oral language acquisition. Oral language reinforces the development of reading and writing (Snow & Beals, 2006; Snow, Burns, & Griffin, 1998). When children display poor oral language skills, their acquisition of more advanced levels of reading and writing is at risk (Catts, Fey, Tomblin, & Zhang, 2002; Pullen & Justice, 2003). Research indicates that children from low-SES backgrounds exhibit lower levels of oral language skills than do children from higher SES backgrounds on measures of language production and comprehension. These differences can be found in research examining developmental ranges from infancy to high school, with the gap widening as the age increases (Fernald et al., 2013; Hoff, 2006).

When mothers from low-SES backgrounds have limited education, styles of oral conversation with their children tend to consist mostly of short sentences that are imperative in nature, and verbal interactions are characterized by fewer responses and

questions. This is in stark contrast to mothers from middle- and high-SES backgrounds who typically adopt more complex language and vocabulary with their children (Adams & Ramey, 1980; Hart & Risley, 1995; Hoff-Ginsberg, 1991; Hofferth & Sandberg, 2001). Hoff, Laursen, and Tardif (2002) noted that higher SES mothers spoke more frequently to their children than did lower SES mothers. They also found that high-SES mothers tended to elicit conversations rather than direct their children's behavior, the conversational style typically adopted by low-SES mothers.

Research spanning over forty years suggests that early home language and literacy practices play a significant role in academic achievement (Bernstein, 1971; Cummins, 1991; Heath, 1983; Hoff, 2006). Although academic literacy is specifically found in school contexts, precursors of academic literacy are often found in caretaker-child interactions even before the child enters school. Therefore, the development of academic literacy can be seen as a mediating link between early exposure to a literacy-rich environment in the home and later school achievement (Leseman, Scheele, Mayo, & Messer, 2007).

In sum, for children to attain academic literacy, they need to learn to recognize the function, structure, and demands of language used in the classroom. When students encounter gaps in academic language, it leads to an academic literacy gap, that in turn leads to a gap in academic achievement gap (Johnson, 2009). Hirsch (2003) succinctly states: "It is now well accepted that the chief cause of the achievement gap between socioeconomic groups is the language gap" (p. 22).

In addition to academic literacy, another factor crucial for academic achievement is intelligence, particularly verbal intelligence. Research indicates a strong association between verbal intelligence and academic achievement. Lohman (2009) argues that with regards to English-language acquisition, the main language for academic discourse, the ability to engage in verbal language and current academic success are the chief predictors of future academic achievement.

To understand academic achievement within the context of verbal intelligence, one needs to begin with an understanding of intelligence, a cognitive ability. Generally, low-SES children receive less cognitive stimulation than high-SES children. For example, children from low-SES families are less likely to be read to or coached in learning skills, and they tend to own fewer books (Coley, 2002; Evans, 2004). The next section on poverty and intelligence deals with literature pertaining to intelligence, in particular, the types of intelligence, recent brain research on intelligence, and the implications of such research of children raised in poverty.

Poverty and Intelligence

The observation that intelligent individuals perform well in different tasks involving cognitive abilities can be attributed to Spearman's (1904) discovery of a general intelligence factor, or *g*. Spearman (1904) conducted tests of mental ability that included specific areas of cognition: verbal fluency, mathematical reasoning, and spatial visualization. The general intelligence factor or *g* was statistically extracted using factor analysis. Spearman (1904) found that despite the myriad content of the mental ability tests, performances on all of the tests indicated a universal element of intellectual ability.

Researchers are of a similar view, arguing that *g* exists and that it plays a role in many facets of an individual's life (Carroll, 1993; Gottfredson, 2004; Jensen, 1998). These include individual differences in ways of learning, reasoning, and problem solving, as well as in predicting employment choices, scholastic achievement, and lifetime income (Gottfredson, 1997; Toga & Thompson, 2005).

Aside from *g*, a recent contribution to the area of intelligence study is the distinction between *crystallized intelligence (gC)* and *fluid intelligence (gF)* (Cattell, 1987). gC is the acquired accumulation of knowledge or expertise, the result of learning, education, and experience. In school, such acquired knowledge includes reading and writing skills. On the other hand, gF is the innate ability of all human beings to reason, discern patterns in logical relationships, and apply logic, none of which are dependent upon background knowledge or education. In school, gF manifests itself as the ability to solve problems, of figuring out what to do and, acquiring the new skills necessary to do it.

Is it then justifiable to conclude that gC and gF are two different forms of intelligence? In his seminal work, Carroll (1993) reanalyzed more than 400 datasets of cognitive ability scores. Based on his reanalysis, he concluded that gC and gF were correlated, and that *g* accounted for nearly 50% of the variance in a wide range of cognitive tests. Although this percentage did fluctuate from one study to another, it suggests that a general factor of intelligence does exist.

In the Cattell-Horn model of intelligence (Horn & Cattell, 1966), *g* is the dominant factor in the hierarchy of human cognitive abilities: the next two dominant

factors are gC and gF intelligences. Reynolds and Kamphaus (2003) point out that fluid and crystallized intelligences exhibit a close association with nonverbal and verbal intelligences respectively. Nonverbal intelligence is innate, indicating both ability and potential; verbal intelligence is learned and leads to academic scores that indicate the student's ability to perform in the classroom (Marzano, 2003).

So how do the roles of verbal and nonverbal intelligences play out in building children's academic literacy? Cognitive tests that measure verbal, quantitative, and nonverbal reasoning skills are extensively adopted by schools to provide useful information to teachers who want to tailor their instructional practice to their students' particular cognitive strengths (Lakin, 2012; Lohman, 2009). Verbal and quantitative skills (otherwise known as verbal intelligence) are particularly critical for academic achievement because of the deep reliance on these skills in traditional academic content areas.

In addition, studies tie academic literacy to verbal intelligence (Arnold & Doctoroff, 2003; Lohman, 2005; Fernald et al., 2013). In particular, one study conducted in a West Texas school district indicated that children from poverty backgrounds had the intellectual capacity to achieve but underachieved due to low verbal intelligence (Juntune et al., 2011). Therefore, many researchers have criticized the exclusive use of nonverbal tests to predict academic achievement because these tests lack the obvious links that verbal and quantitative reasoning have to the creation of academic literacy, and therefore to the achievement of academic success (Braden, 2000; Lakin & Lohman, 2011; Ortiz & Dynda, 2005).

Children from poverty often demonstrate developmental gaps between their verbal and nonverbal intelligences (Cummins, 1979; Duncan et al.,1998). Studies indicate that the effect of poverty seems to be stronger on verbal intelligence than nonverbal intelligence (Schoon, Jones, Cheng, & Maughan, 2012; Farah et al., 2006; Noble, McCandliss, & Farah, 2007;). Given the wealth of research highlighting the differences in the extent of cognitive stimulation received by children from low- and high-SES families (including literacy-rich environments and the types of family conversations), research suggests that verbal intelligence is one of the key underlying factors in building academic literacy for academic achievement (Adams & Ramey, 1980; Davis-Kean, 2005).

Verbal intelligence forms the basis of academic literacy because it aids in the processing of abstract concepts. Research has consistently demonstrated that students' reading achievement scores received on first grade assessments are highly correlated with reading and math test scores throughout the students' school career (Arnold & Doctoroff, 2003; Duncan et al., 2007). In addition, poor reading skills can affect future reading and math achievement because even math achievement tests require verbal skills to solve word problems (Crawford et. al., 2001).

A large body of work suggests that socioeconomic status is widely associated with a number of indices of cognitive ability or intelligence, such as Intelligence Quotient (IQ), literacy, achievement tests, and school retention rates (Baydar, Brooks-Gunn, & Furstenberg, 1993; Brooks-Gunn, Guo, & Furstenberg, 1993; Liaw & Brooks-

Gunn, 1994; Najman et al., 2009; Smith, Brooks-Gunn, & Klebanov, 1997). Children raised in low-SES families tend to begin school with lower-than-average IQs (Gottfredson, 2004), highlighting the chasm between children raised in poverty and those who are not. Many children raised in poverty do not receive the crucial cognitive stimulation in the early years before they enter school. As a result, they experience underdeveloped cognitive, social, and emotional competencies, which influence their IQ and growth in academic literacy skills crucial for educational achievement (Tong, Baghurst, Vimpani, & McMichael, 2007).

Two concepts that are fundamental to working with children from poverty in terms of their brain development are *neural plasticity* and *epigenetics* (Jensen, 2009). First, neural plasticity refers to processes that involve changes in the neural circuits that occur in response to experiences. This phenomenon is linked with changes in synaptic connections between neurons, the addition of new neurons, and an increased myelination of axons (Garlick, 2002). Garlick (2002, 2003) proposed that if brains differ in their ability to regulate neural connections based on experience, then it follows that individuals with a higher functioning of neural plasticity might exhibit greater intellectual capacity.

Second, epigenetics, a relatively new field of research, is the study of heritable changes in the function of genes that occur without any change in the primary DNA. For example, genes can either be activated or deactivated by environmental factors such as nutrition and stress, which can strengthen or impair learning and memory (Rutter, Moffit, & Caspi, 2006). For optimal brain development, young children require

opportunities for engaged, healthy learning. Results from a series of meta-analyses of 139 studies indicate that a change in gene expression influenced by environmental factors associated with poverty (such as inadequate health care, stress, and depression) is what led to infants exhibiting an increased level of disengagement (van Ijzendoorn, Vereijken, Bakermans-Kranenburg, Riksen-Walraven, 2004). As a result, children raised in poverty tend to adapt to suboptimal situations that result in underachievement and poor behavior in school (Jensen, 2009).

Research work in neural plasticity and epigenetics demonstrates that IQ is not a fixed entity, but rather a variable one (i.e., IQ can increase). One adoption study tested the theory that IQ is not fixed (Duyme, Dumaret, & Tomkiewicz, 1999). The researchers identified 65 adopted children out of a random sample pool of 5,003 adopted children. The 65 children were adopted between the ages of four and six and had a preadoption IQ level of 77. They were placed in higher income homes and consequently their adoptive parents were more likely to provide greater cognitive stimulation than families with lower household incomes. After eight years, the 65 children were found to have higher IQ scores in adolescence, some by as much as 20 points. An earlier study by Capron and Duyme (1989) concluded that children adopted by high-SES parents scored higher on IQ tests than children adopted by low-SES families.

Studies involving educational intervention have indicated the potential to narrow the academic performance gap between low-SES and high-SES children. For example, low-SES children who participated in intensive early education scored between one half and one standard deviation higher than children who were in the low-income control

groups (Ramey & Ramey, 1998). Other studies have shown that some of these effects are sustained, and that is why intervention programs are deemed to be more effective the longer they run (Brooks-Gunn et al, 1994; Nisbett, 2009). Therefore, research findings collectively suggest that apart from genetics, factors such as neural plasticity and epigenetics function to affect cognitive ability.

So the question remains: how can children from poverty build academic literacy and experience academic success? Research studies from bilingual education provide clues to understanding how to build language skills in low-SES children. One clue is the development of language in limited English proficient (LEP) students through the interaction of verbal and nonverbal representational systems; such activity provides an avenue for students to build mental and imaginational images as bridges to the verbal concepts needed to function in the second language (Gonzalez, 2002).

Another clue is that research studies suggest that students construct and use associative networks that build connections from images to words and names to pictures through a process called dual coding (Clark & Paivio, 1991). These studies underscore the role of nonverbal intelligence or visualization in helping build the verbal intelligences of children from poverty. The next section in this review discusses the role of visual thinking in building academic literacy and expanding working memory to facilitate productive learning.

Visualization

Learning generally depends on three cognitive strategies: 1) repetition or rote memorization, where information is simply repeated; 2) organization, where information

is ordered into meaningful units for greater retention; and 3) elaboration, where learners verbally construct the meaning of the information through spoken and written statements or non-verbally through mental images (Hodes, 1994). All of these cognitive strategies, and particularly organization and elaboration, constitute ways of producing more meaningful processing.

A particular focus in this literature review is elaboration strategies, which include the processes of construction and integration. Learners are constructors of information and need to actively process new information in ways that make sense to them. Early research in constructivism has indicated that learning occurs when people actively construct their own internal and subjective representations of reality (Piaget, 1954; Vygotsky, 1978). According to Piaget (1954), new knowledge that is compatible with the learner's existing schemes or mental constructs is assimilated. However, if this new knowledge cannot be assimilated, it may be accommodated through changes to the learner's current mental constructs or by the creation of new ones.

Further, Vygotsky (1978) posited that complete mental constructs cannot be transmitted from the teacher or instructor to the learner as the learner must actively integrate and process new knowledge. In short, the learner is not a tabula rasa; instead, knowledge is constructed based on personal experiences, observations, and prior knowledge of the environment. In a classroom situation, when students connect what they are learning to relevant and accurate prior knowledge, they learn more easily and retain more information. Essentially, "new knowledge 'sticks' better when it has prior knowledge to stick to" (Ambrose et al., 2010, p. 15).

In addition to constructing new information from prior knowledge, elaborative processing involves visualization or mental imagery to bridge linguistic barriers (Mayer, 1984). As an elaboration strategy, visual mental imagery has been hypothesized to play a key role in various kinds of thinking and problem solving (Gagne, 1985; Finke, Pinker, & Farah, 1989; Paivio, 1991). Since elaborations, such as the creation of mental images leave distinctive traces in the memory, these mental images can aid in the assimilation and retention of new information.

Humans become adept at visualizing mental images long before they are able to think in lexical form (Hodes, 1994). Horowitz (1983) noted that in early childhood, image-based schemata were used as a method of dealing with information prior to the thinker's development of lexical thought. While the use of imagery in adults is mutable, it is more often utilized as a skill in children. As communication skills become more advanced, the ability to sequence and organize words by meaning continues to increase; the learner no longer depends upon imagery alone. This ability can lead to higher-order thinking skills, where concrete representations (aided by imagery) merge with other associative processes at the abstract level. This suggests a dynamic dual interaction between the verbal code or linguistic units and the non-verbal code or visual mental images. In fact, specific uses of mental imagery that have been empirically examined include the comprehension and learning of text materials (Dunlosky et. al, 2013).

For decades, researchers have studied the role of visual images in promoting children's literacy (Dyson, 1983; 1986; Kendrick & McKay, 2004). Dyson (1986) proposed that visualizing through drawing, coupled with talking, are active components

of the literacy process. In addition, Levin and Bus (2003) showed how children who were unable to communicate spontaneously through writing instead resorted to drawing, suggesting the prevalence of the urge to draw images as a means to communicate. As Graves (1983) found in his ethnographic study, children's drawings are likely to possess more information than their written texts.

Some curriculum practices capitalize on children's experiences with the world around them by incorporating recognizable images. One example is the "talking drawings" strategy (Paquette et al., 2007) where students create drawings before they learn the content knowledge associated with a particular topic. After the drawings are shared, the students listen to or read an expository text on the same topic, and through peer discussion, develop ways to modify their initial drawings to reflect their new understanding of the topic. Another example is the use of drawings to organize ideas before writing stories (Baghban, 2007). Finally, another strategy is learner-generated drawing where learners construct drawings of concepts described in a given text (Alesandrini, 1981; Johnson, 2009; Van Meter et. al, 2006).

Dual coding theory of cognition. One of the most well-known works on visualization is Paivio's (1969; 1978; Weinstein, 1986) dual coding theory of cognition (DCT). Paivio opined that verbal and nonverbal information are processed in functionally autonomous but interconnected systems. The verbal system or *logogens* deals directly with language while the nonverbal system or *imagens* deals with nonlinguistic objects and events. Logogens are hierarchical sequential structures of increasing length, ranging from phonemes (or letters) to syllables, words, phrases,

sentences, and other longer discourse units. Imagens, on the other hand, are mental representations that yield conscious imagery from different modalities such as the visual, auditory, or motor domains (Paivio, 2010). Imagens are also organized hierarchically but their hierarchy is comprised of spatial nested groups such as pupils within eyes within faces (Paivio, 2010, p. 210). Recent studies in brain imaging confirm that verbal and visual information are processed in both discrete and overlapping regions of the brain (Childers & Jiang, 2008).

Perhaps the most productive application of DCT has been in the area of academic literacy, such as in comprehension and response in reading (Sadoski & Paivio, 2013). For example, nonverbal mediators play a fundamental role in facilitating verbal learning (Gagne, 1985; Sadoski, Goetz, & Avila, 1995). Gagne (1985) points out that images serve to decrease the burden of information processing so that the largest amount of information can be stored in the limited capacity of the working memory. This process then enhances a greater retention of information in long term memory, a crucial component in academic achievement. Further, although concrete words and phrases may elicit better recall than abstract words (due to their high imageability) Sadoski and colleagues (1995) contended that the use of concrete referents are still useful in helping learners comprehend abstractions. This implies that the use of visual imagery can be used as a bridge to comprehending abstract concepts commonly found in academic settings.

Another aspect of DCT is its emphasis on early development of the nonverbal systems as the foundation for later language acquisition and skill (Paivio, 2008).

According to Paivio (2008) and based on Piagetian principles, early child development is based on sensorimotor experiences with concrete objects and situations. It follows then, that cognitive development depends upon the richness of early nonverbal experiences. These experiences are increasingly associated with the language experience crucial to the development of the verbal component of a complete dual coding mind.

In an educational setting, DCT aids the information processing needed in academic literacy by assisting the learner in making connections between mental representations created in the visual and verbal systems (Paivio, 2008). According to Cheng and Gilbert (2015), information processing is accomplished in two ways. The first is through associative connections, which involves making connections between associated mental visual representations made within the visual system. An example is visualizing images that represent various aspects of the human circulatory system. The second is the formation of referential connections, which involves making connections between mental visual representations and mental verbal representations. An example is the assignment of a name or description to a visual representation, such as when students describe in words a visual they produced on how blood flows through a human body.

With regards to referential connections, Paivio (2008) emphasized the visualization-verbalization procedure. That is, classroom instruction entails the use of images for text segments such as words, phrases, and sentences: students are encouraged to describe their images in progressively greater detail. For instance, Sadoski and Willson (2006) found that students in the third, fourth, and fifth grades from low reading achievement schools in the Pueblo School District of Colorado dramatically increased

their reading performances as a result of visualization-verbalization techniques used in a multi-school intervention program. These students were taught how to concretize text by using imagery as they read.

In addition, Purnell and Solman (1991) discovered that combining mental imagery and verbal elaboration in technical material (such as geography texts) was effective in promoting understanding and learning in students from grade school through the university level. Another intervention program for mathematics involved teaching students how to use visualization to represent numbers and operations. Again, anecdotal evidence supported the effectiveness of visualization-verbalization techniques (Tuley & Bell, 1997).

Visualization techniques, a central element of DCT, can address poor academic achievement in any child. These techniques appear to be particularly useful in helping children from low-SES backgrounds who are often at risk for oral and literate language difficulty; they serve to build the complex language skills needed for academic literacy (Burt et al., 1999; Pruitt & Oetting, 2009). To overcome challenges in this area, children from low-SES backgrounds can be assisted in building complex language through a visualization strategy called mindsketching (Juntune, 1987; Juntune, 2012).

Mindsketching is different from other drawing strategies: the intent is to capture an image of a concrete or abstract idea by sketching it in very few lines (Juntune, 1987; Juntune, 2012). The dual coding theory (Paivio, 1969; 1978) suggests that images, even with little detail, leave a distinctive trace in the memory, facilitating the retention of

verbal and written information. Students from poverty have been shown to better retain information when they use visualization techniques to help them build academic literacy.

To illustrate, the Reynolds Intellectual Assessment Scales (RIAS) was administered to 1,034 students in poverty from four different locations in Texas (Juntune, 2012). The results indicated a mean verbal memory IQ of 82.85 points (the average mean score is 50 points). Nonverbal memory IQ was measured at 111.89 points. Juntune (2012) suggested that these results highlight the ability of students from poverty to leverage their nonverbal memory to assimilate verbal information. Put another way, a learner must hold a mental image in his or her memory long enough to search for the verbal information needed to communicate that image (Juntune, 2012). Therefore, the process of leveraging the nonverbal memory to facilitate the retention of verbal information through mindsketching may offer hope and possibilities for children from poverty seeking to build academic literacy.

Memory and cognitive load. Paivio's DCT (1969; 1978) also postulates that performance in memory is mediated not only by linguistic processes, but also by nonverbal processes. Thus, mental imagery supports the recollection of verbal information, where words conjure corresponding images. Apart from visual thinking, information processing speed and working memory also impact a student's level of achievement in school (Luo, Thompson, & Detterman, 2006). Research in brain function indicates that to accomplish academic achievement, the brain must utilize a collection of neurocognitive systems. One of the key systems is the medial temporal/memory system which stores memory. The working memory is a dynamic memory system that

manipulates and stores information: both are crucial processes for learning (O'Donnell, Reeve, & Smith, 2009).

Burgeoning evidence suggests that children who struggle with memory problems and inattention are less able to utilize learning opportunities than children who can remember and retain information (Blair, 2002; Blair & Razza, 2007; Raver et al., 2011). A vast majority of children with poor working memory face difficulties in various subjects such as reading, math, and science (Gathercole et al., 2008; McLean & Hitch, 1999; St Clair-Thompson & Gathercole, 2006). These studies indicate that children with poor working memory often find themselves unable to meet the demands of structured learning activities that require verbal processing.

Emphasis on verbal learning can burden the limited capacity of the working memory. When information is permanently lost from the working memory as a result of overloading and distractions, tasks cannot be completed successfully because critical information is unavailable or too difficult to process. Gathercole (2008) and her colleagues noted that what appeared on the surface to be situations where students disobeyed, rebelled, or had challenges understanding academic content could often more accurately be attributed to poor working memory. Examples included circumstances in which students forgot instructions, could not remember the goals of an assigned task, and did not recall information pertinent to the successful completion of a task.

The expansion of working memory is best understood through Cognitive Load Theory (CLT). Developed by Sweller (1988), CLT is based on classic research by George Miller (1956) on how the working memory can only recall between five and nine

items, depending upon the type of information during one exposure. The working memory is limited; this is different from long-term memory, which has a vast capacity and is able to store information on an enduring basis (Siegler, DeLoache, & Eisenberg, 2014).

Despite the limitations of working memory, research suggests the amount of information that can be remembered or retrieved depends upon the quality of encoding, the process of taking in the information (O'Donnell et al., 2009). This is not to say that success is merely a function of time, that the longer the information stays in the short-term memory, the more likely it will be stored in the long-term memory. Instead, it is more about the ability to organize complex information in the working memory before it is encoded in the long-term memory. When information is properly encoded, remembering that information is easier.

Key processes in quality encoding include organization, elaboration, and imagery (Woolfolk, 2013). Firstly, information is best remembered when it is well organized, especially if the material is extensive or complex. One popular method of organization is chunking, taking small units of information and grouping them into larger meaningful chunks (Miller, 1956; Thornton & Conway, 2013) Secondly, elaboration entails adding meaning to new information by connecting it to information one already knows. This process builds additional linkages to existing prior knowledge (Bruning, Schraw, & Norby, 2011). Examples include explaining a concept to a peer, creating examples, or applying the information to a new problem (Woolfolk, 2013). Thirdly, images are useful for remembering information. As mentioned earlier, acording to DCT, images and words

are represented as imagens and logogens respectively (Paivio, 1986). Baddeley's (1999) research on separate working systems for visual and verbal information support the efficacy of learning and remembering information in both visual and verbal forms.

The basic premise of CLT is that since working memory is limited, learners may be bombarded by the complexity of information; such bombardment can cause cognitive overload, leading to learning impairment (Sweller, van Merrienboer, & Paas, 1998). The implication is that a learner's underlying cognitive structure should be considered in instructional design. Otherwise, the instructor risks subjecting the learner to unnecessary cognitive load if instructional strategies are not aligned with the learner's limited cognitive processing resources (Sweller & Cooper, 1985).

There are three basic types of cognitive load (Sweller et al., 1998). The first is *intrinsic cognitive load*, which refers to the complexity of the instructional content. The second, *extraneous cognitive load*, refers to a cognitive load caused by an ineffective instructional design. Both of these types of cognitive load impede learning. The third is *germane* or *relevant cognitive load*. This term refers to the productive effort that learners engage in that leads to effective learning.

For effective learning to occur, learners must be actively engaged in processes within the instructional design that facilitate germane cognitive load. One approach is the worked example, which is the type most widely studied for its cognitive load effects (Paas, Renkl, & Sweller, 2003). This approach entails the instructor demonstrating a problem solution. Next, learners complete small parts of worked-out examples, and then progressively complete larger parts of additional worked-out examples until the target

task is completed. Another approach is to counter the redundancy effect. Chandler and Sweller (1991) found that simply having a self-explanatory diagram (such as one demonstrating the flow of blood to the vital organs alone) can result in a better quality of learning than having the same diagram with redundant text re-describing the image. The goal of these two approaches is to increase the germane load and enhance learning.

Now that the foundational theoretical concepts of poverty, academic literacy, intelligence, and visualization (including memory and cognitive load) have been reviewed, it is useful to explore how teachers' thoughts and perceptions come into play in the classroom. The next section of the literature review deals with how teachers' thoughts and beliefs impact their teaching practice.

Teacher Cognition

Teacher cognition refers to the cognitive dimension of teaching that is not observable: mainly, it includes what teachers think, know, and believe about all aspects of teaching and learning (Borg, 2003). In the 1970s and 1980s, educational research was commonly termed process-product research, where the focus was on the impact of teacher behavior on student performance (Brophy & Good, 1986; Doyle, 1986). However, in the last 25 years mainstream educational research has also acknowledged the impact of teacher cognition in the classroom, as evidenced by several reviews of this work especially in the area of language pedagogy (Borg, 2003; Calderhead, 1996; Carter, 1990; Verloop, Van Driel, & Meijer, 2001).

Research in teacher cognition has revealed that teachers are active decision-makers who make frequent instructional choices in their classroom practices (Borg,

2003). In fact, Pajares (1992, p. 3) pointed out that there is a "strong relationship between teachers' educational beliefs and their planning, instructional decisions, and classroom practices." These choices are made by drawing from complex and personalized networks of thoughts, knowledge, and beliefs (Borg, 2003).

In reviewing the literature, Borg's (2003) model is widely used in the area of teacher cognition. It consists of four inputs that influence teacher cognition and their related effects on one other. The first input is schooling, which refers to teachers' school experiences as learners. The second input is professional coursework, which refers to the pre-service and in-service training teachers receive before and after certification. The third input is contextual factors, which refers to the broader educational landscape such as class size, class load, and testing measures. The fourth input is classroom practice, meaning the sum of the teachers' experiences while in the classroom.

This study focused more on the fourth input, classroom practices pertaining to mindsketching. As an aside, it is worthwhile to note that this study is not a study on teacher cognition: other inputs are not central to its purpose.

Summary

Students from poverty enter the classroom equipped with the language of their home and community, but not equipped with the language of the classroom. Many are ill-prepared for the rigor of academic learning, and therefore, fall by the wayside due to a lack of the academic literacy required in a school setting. Further insight into how academic literacy entails building complex language in a school setting can be gleaned from understanding how children from poverty engage in productive learning. This

study explores mindsketching, a visualization technique utilized by teachers in their instructional practice, in an effort to help students from poverty build academic literacy in the school setting.

CHAPTER III

METHODOLOGY

During the halcyon days of scientific inquiry in teaching, Schwab (1971) developed his conceptualization of education and envisioned a dialogic perspective of curriculum. Through his perspective, teachers were viewed as active and knowledgeable contributors of stories about work and life in the classrooms. Schwab was one of the first educational theorists to call for educational researchers to pay close attention to the lived experiences of teachers and their students (Elbaz-Luwisch, 2007). Several researchers who followed (e.g. Bruner, 1986; Polkinghorne, 1988) also took qualitative approaches to psychological studies, especially those on learning.

Qualitative research is a broad-brush term encompassing several interpretative practices of inquiry. A common underlying assumption of qualitative research is that reality is created when individuals interact with their social worlds (Merriam, 1998). The intent of qualitative researchers is to study individuals in their natural settings in order to make sense of the meanings people ascribe to their social worlds (Denzin & Lincoln, 1985). Qualitative research was best suited for the study as it allowed construction of a holistic picture of the phenomenon being studied from those who had shared an experience, namely using mindsketching in their classrooms.

Scientific traditions grounded in positivist philosophies hold the standpoint that observable data constitute the foundation of knowledge (Lincoln, Lynman, & Guba, 2011). Results from positivistic studies typically suggest generalizable and predictable outcomes (Lincoln & Guba, 1985). However, while traditional scientific approaches

provide invaluable insights, they also present voids in our knowledge. As a result, alternative approaches, such as qualitative approaches, allow for different explanations and understandings that can serve to stimulate new ways of thinking about a phenomenon under study.

As such, a naturalistic approach afforded the best fit for the study as it allowed for an "emergent" research design (Lincoln & Guba, 1985). An emergent design allows for flexibility in data collection as the naturalistic researcher makes value judgments about the quantity and quality of data being collected. The naturalistic researcher may adjust the data collection approach accordingly to enhance "richness" of the data and allow the design to grow organically throughout the study. Moreover, emergent designs do not entail the use of a priori theories as naturalistic researchers believe that a priori theories cannot anticipate the myriad views, beliefs, and experiences held by research participants (Lincoln & Guba, 1985).

Naturalistic inquiry emphasizes understanding and interpreting human experience as it is lived (Erlandson, Harris, Skipper, & Allen, 1993). It holds that human experience is personal and can only be described by the participants actually engaged in the phenomenon under study. As the individual and the social world is intertwined, Bruner (1990, p. 35) states that narrative is, in fact, "an organizing principle by which people organize their experience in, knowledge about, and transactions with the social world." Cresswell (2005) asserts that any qualitative approach may have a narrative form of representation, as narrative is the common thread that runs through all qualitative approaches. It is through the vehicle of narratives that individuals make sense of the

world and themselves. Narrative researchers believe that human experience is a lived experience that needs to be narrated in order for human knowledge to be understood and interpreted. Thus, this study elicited teachers' narratives about the use of mindsketching with students from poverty.

Participants

The participants consisted of a purposive sampling of seven elementary school teachers from three schools within a single school district in west Texas. Purposive sampling is central to naturalistic research and the purpose is not to generalize the findings to a broader population (Erlandson, et. al, 1993). Rather, purposive sampling involves selecting "information-rich" cases that best help to answer the research questions that correspond to the purpose of the study (Patton, 2002). Participants were identified by the school district as "high implementers" of mindsketching strategies. All were females, ranging in ages from late 20s to early 50s. Five participants listed themselves as "Hispanic" when asked for their self-reported ethnicities, while two participants self-identified as "White." Table 1 provides more detailed information of the seven participants.

Table 1

Demographics of Participants

Pseudonym (Gender)	**Self-reported ethnicity**	**Number of years taught**	**Number of years using mindsketching**	**Age range (years)**
Beverly (F)	Hispanic	12	5	41-50
Cheryl (F)	Hispanic	19	5	41-50
Deborah (F)	Hispanic	8	5	21-30
Helen (F)	Hispanic	17	5	41-50
Rosalind (F)	White	5	5	41-50
Tina (F)	White	18	4	51-60
Winnie (F)	Hispanic	21	4	41-50

Five participants came from two elementary schools considered "high poverty" schools as more than 85% of the students were eligible for free or reduced-price lunch (FRPL) programs (National Center of Education Statistics, 2014). Two participants came from a mid-poverty school in which 48.4.% of the student population was eligible for FPRL programs (National Center of Education Statistics, 2014), but reported that over 75% of the students in their specific classes were on FPRL programs.

Each of the participants had completed 12 hours of professional development training (two six-hour sessions within two years) conducted by an educational consultant on building academic literacy in children from poverty. A key instructional strategy

taught at the training was mindsketching. Each teacher who participated met the following criteria:

1. Each had attended two years of monthly one-hour sessions on how to use mindsketching in the classroom. Sessions were held on-site during school planning time and conducted by in-district personnel.
2. Each had used the mindsketching techniques in their classrooms at least twice a week for the past two years.
3. At least 75% of the students in each of their classrooms came from low income backgrounds, based on eligibility for free or reduced lunch programs.

The Human Instrument

The researcher is the primary instrument to gather, analyze, and interpret data (Denzin & Lincoln, 2000). Patton (2002) notes that it is imperative to disclose the researcher's positionality in the study as the researcher brings with her personal biases, beliefs, and values that can affect the research process. The researcher in this study acknowledges her own lenses of reality and beliefs which may have shaped the way she examined a phenomenon and processes in this study. The researcher was a high school teacher who also had administrative experience as head of department and assistant principal. While the researcher understood the complexities involved in teaching and learning, her interest in the current inquiry was piqued by her own experiences with students who came from low SES families. In addition, given that the researcher was Singaporean-Indian and had not taught in an American classroom, she needed to

continually attend to the possibility of misinterpreting cross-cultural information gleaned from interviews and classroom instruction.

Erlandson and his colleagues (Erlandson et al., 1993) describe the human instrument as a "wonderful data-processing organism" (pg. 107). The researcher used a reflexive journal, akin to a daily journal, to capture thoughts and insights on the research process that shaped the way issues were viewed (Lincoln & Guba, 1985). The researcher made it a point to capture these thoughts and insights immediately after an interview or classroom observation. Reflexive journal entries varied in length–from three paragraphs to four pages. The reflexive journal was also used to keep track of the researcher's own growth over time (Erlandson et al., 1993). Although the veil of objectivity is not presumed to be achieved in a qualitative study, the researcher's sense of reality was bracketed through the use of this reflexive journal each time after data was collected.

Data Collection

The researcher directly collected data from two different sources−individual semi-structured interviews and classroom observations. These two sources provided triangulation of the data and increased the robustness of the study.

The researcher first interviewed the participants using a semi-structured interview protocol in a face to face setting. Although the researcher was guided by a set of pre-determined questions, the semi-structured process allowed participants to share relevant information that was not covered by the interview protocol. A follow-up electronic mail was sent to two participants to clarify information gleaned from the

interviews. This follow-up format was chosen to clarify certain acronyms and terms used by these teachers.

The researcher also gathered data from classroom observations. These observations focused on specific mindsketching techniques in a variety of content areas taught by the teachers or used by the students during the lesson. Two observations were conducted for each of the five participants while one observation was conducted for each of the remaining two participants. Five participants taught more than one subject, including language arts, science, history, and social studies. For these participants, two classroom observations were conducted to obtain data on the use of mindsketching across content areas. The other two participants taught one subject, language arts, hence only one observation each was conducted. For all the participants, classroom observations lasted two hours per teacher and were scheduled over two weeks.

Procedures

Semi-structured interviews. The focus of this inquiry was to educe first-order narratives wherein participants shared stories of themselves and their own experiences (Elliot, 2005). To that end, the interviews provided a means of collecting information that the researcher could not observe directly (Patton, 2002).

For this study, an initial interview protocol was designed based on the research questions of this study. Prior to the actual interviews with the participants, the researcher conducted pilot interviews with three colleagues who were teachers. The chief purpose of these pilot interviews was to refine the interview questions and protocol so that

participants could provide rich, specific, and relevant details (Gillham, 2000; Kvale, 1996).

One of the teachers in the pilot interviews had experience with mindsketching, but the other two teachers did not. For those two teachers, the researcher substituted the term "mindsketching" for "problem-based learning" as they were experienced in that methodology. Such wording was considered irrelevant as the researcher was primarily interested in how they provided details, descriptions, and explanations in response to the interview questions. The researcher took notes of the teachers' demeanor as they responded to the questions, particularly when they exhibited difficulty in explaining or when they needed more clarification. The researcher sought feedback from the teachers in the pilot interviews and made some changes to the initial interview protocol. The complete and updated interview protocol is found in Appendix A.

The researcher made two week-long trips to the field site, one towards the end of the school year and another, at the start of the new school year. During the first visit, each participant was interviewed in person, lasting from 60 to 75 minutes. The researcher used a semi-structured interview strategy for the interviews. This semi-structured interview process allowed the researcher to be guided by a set of basic questions and enabled the researcher to pursue relevant information and emergent ideas which might not be obtained from the interview questions (Merriam, 2009). Furthermore, the researcher adhered to the guidelines spelt out by Kvale (1996) on quality criteria for an interview–having shorter questions and the opportunity for longer

responses, and the interview being "self-communicating," that is, the interview could become a self-contained story in itself without superfluous details.

During the second visit, at the start of the school year, five teachers were interviewed as two other teachers were away for professional development activities conducted in another location. For this visit, the interviews lasted from 20 to 30 minutes. The focus of these interviews was to gather more data on how teachers used mindsketching and how they initiated mindsketching strategies when new students unfamiliar with these strategies joined their classes at the start of the academic year.

The researcher scheduled the interviews at the convenience of the participants. Some interviews were conducted in their classrooms when the students were in another class or after school hours. The rest of the interviews were conducted in a conference room to ensure privacy. The researcher followed all procedures as detailed by the Human Subjects IRB (Institutional Review Board) at Texas A&M University. The participants were informed ahead of time about the study and consent forms were sent to them via email before the interview so they could read what the study entailed. The participants signed the consent forms in the presence of the researcher before the start of the initial interview.

All the interviews were digitally recorded using a small unobtrusive recording device. Observational notes were taken during the interview to document the researcher's thoughts and/or the interviewees' nonverbal behaviors. Field notes were immediately entered into the reflexive journal following each interview to record the researcher's reflections.

Once the field notes were reviewed and corrected, the researcher filled out a contact summary sheet. This sheet contained focusing or summarizing questions to help the researcher reflect on the main points of each interview, to guide planning for the next interview, and for the researcher to have an immediate perspective of the emerging data (Miles & Huberman, 1994). The following questions were adapted from a contact summary sheet developed by Miles and Huberman (1994, pg. 53):

1) What were the main points or emerging themes that struck you with this participant?
2) Summarize the information you received/or did not receive for each of the interview questions for this participant.
3) What new questions do you have for the next participant?

An example of a completed contact summary sheet can be found in Appendix B.

Follow-up interviews were conducted via questions typed in an email. These follow-up interviews were used for the following purposes: (a) to ask further questions that emerged during the research process, (b) to clarify any questions the researcher had after the researcher had conducted classroom observations, and (c) to provide an avenue for participants to provide further information and insights. Follow-up emails were sent to four participants and they all responded. Their responses were added to the interview data. The seven participants were also notified that as the data emerged, the researcher would be in additional contact with the participants if more data needed to be collected.

Following each interview, the researcher transcribed all the digital recordings. After transcribing the data, the researcher reviewed the transcripts for accuracy and

edited them for errors. Any notes taken by the researcher during the interview were added next to the relevant part of the transcript. Member checks were conducted to ensure the accuracy of the transcripts. This was done by sending each participant an electronic copy of the transcript to review for contextual or content errors. Although the participants were given the opportunity to share any comments, observations, or omit any information about which they might have felt uncomfortable, all the participants replied they were satisfied that the transcripts were accurate.

Classroom observations. Corbin and Strauss (2008) stress that utilizing a spectrum of potential data sources is one of the "virtues" (p. 27) of qualitative research. To that end, interview data was supplemented by observational evidence from the classroom. Classrooms are ecosystems in which teachers, students, practices, beliefs, and skills all interact with each other. Observations of teachers using mindsketching strategies in the classroom assisted the researcher to gain a comprehensive understanding of the context and to record a first-hand account of participant behavior and activity (Merriam, 2009). In addition, Spradley (1980) noted five types of participant observations on a continuum, ranging from non-participation to full participation of the researcher. In this study, the researcher assumed the role of a passive participant, where the researcher was present in the classroom but did not participate or interact with the teacher or the students.

The researcher conducted two one-hour classroom observations of five of the participants and an hour observation of each of the two participants−a total of twelve classroom observations. Within that hour, the participants engaged their students in at

least two different mindsketching activities. As mentioned in the previous section, the researcher made two week-long trips to the field site. The first round of classroom observations occurred four weeks before the end of the school year whilst the second round of observations occurred five weeks after the start of the school year. As the study focused on the use of mindsketching strategies by teachers, the researcher did not write observational notes on the students' sketches or collect samples of students' work.

The researcher's field notes from the classroom observations included direct quotes from teachers, researcher's descriptions, and researcher's insights based on the observations. The detailed field notes enabled the researcher to develop a descriptive narrative for the study.

Classroom maps. The researcher also drew classroom maps to assist in taking down notes. Classroom maps served as reflective tools for the researcher to help situate and reference any classroom interaction that had been observed (Gay, Mills, & Airasian, 2009). These classroom maps included details of the classroom set-up, such as seating arrangement of the students, as well as descriptions of paired work and other group activities.

Other sources of data. The researcher also collected data on an ad hoc basis as the opportunities presented themselves. First, one source of data was a workshop session where elementary school teachers previously trained in mindsketching were invited to work collaboratively to craft classroom syllabi incorporating the use of mindsketching. With the permission of the workshop instructor and the teachers concerned, the

researcher listened to the conversations of the various groups and wrote down mindsketching ideas and strategies.

Second, during one of the visits to the field site, two teacher participants requested to meet the researcher after school hours to talk about new insights about mindsketching–insights they did not have before and therefore, were not included in their initial interviews. The researcher sat with them and digitally recorded their joint conversation as they shared those new insights. While the researcher occasionally prompted comments and explanations from the two participants (e.g., "What do you mean? Why did you think that?"), considerable effort was made to reduce researcher comments while capitalizing opportunities for comment and explanation by the participants. The conversation lasted forty minutes. The researcher transcribed the recording and sent the transcript to each of the participants for member checking by electronic mail. The transcript was checked by the two participants and retuned without changes. This transcript was added to the other interview transcripts and treated as part of the overall interview data.

Data Analysis

Preparation of transcripts. After the participants had the opportunity to read through their respective transcripts, the researcher inserted pseudonyms in lieu of participant names, dates of interviews, and page numbers in the header of each transcript. In addition to the header on each page of the transcript, the pages were formatted using sequential line numbers and a wide margin to the right of the page. The margins were especially beneficial for notations while unitizing the transcripts for the

data unit cards. Preliminary themes from the notations were recorded in the researcher's reflexive journal.

The data from the interview transcripts and observational notes were analyzed using constant comparative method and thematic analysis (Boyatzis, 1998; Glaser & Strauss, 1967). Merriam (2009) pointed out that the constant comparative method is widely used throughout qualitative research and it entails grouping data units together on a similar category. The thematic analysis approach involves encoding the various categories into patterns that describe and organize them using an inductive approach (Boyatzis, 1998).

Unitizing of data. In preparation for the analysis of the data using the constant comparative method, the data was broken up into single data units of meanings and ideas that could stand alone and still make sense as independent segments. Each data unit expressed a cohesive idea that was unique from the text immediately before and after the unit (Lincoln & Guba, 1985). Any introductory directions or standard closing statements or remarks from the researcher in each transcript were not reflected as data units.

As the unitizing process progressed, the researcher jotted down notes or comments to form an emergent category. This process is called open coding as the researcher, at this point, remains open to units of data that are potentially relevant (Merriam, 2009). Each transcript was manually marked using the symbol [/] to indicate breaks between the individual data units. After the transcripts were unitized, the researcher kept the transcripts in a secure location.

Once the data units were ready, each data unit was followed by a page break to make the creation of individual unit cards easier. The page size was formatted to print on 4" by 6" index cards. Each card retained the unique header that included the pseudonym, interview number, date of interview and page number of the transcript. The unitization process yielded 808 cards.

Card sort and constant comparative method. Data units were categorized using the constant comparative method (Glaser & Strauss, 1967). This process involved segmenting the units of information into categories. The first unit was read and the researcher jotted down notes or comments to form a category. The next unit of data was evaluated to establish if it fitted the category of the first unit or if the unit represented a new category. The researcher did not establish a pre-determined number of categories but instead allowed categories to emerge during the data analysis.

The categories consisted of descriptive phrases that distinguished each category. The researcher utilized self-adhesive notes to label each pile of cards during the sorting process. Throughout the constant comparative process, the phrases were revised to be either exclusive or inclusive as necessary to account for all the units of data. The cards were read repeatedly to allow for new categories to emerge and to ensure the cards would have a good fit with the categories. When faced with a card that could be placed in more than one category, the researcher made the decision to place the card in a category where she thought was a best fit. This technique was used because, if several cards fit in more than one category, the data analysis could be undermined (Erlandson et al., 1993).

The initial sort continued until all the cards had been placed in a category. At the end of the card sort, the researcher removed the self-adhesive notes with the categories and wrote the description of the category at the back of each card with a pencil. This process ensured that for subsequent card sorts, the researcher could begin a new card sort with a fresh perspective.

Two weeks after the first card sort, the cards were reshuffled for a second card sort, and one week after, the cards were again reshuffled for the third card sort. The card sort process was repeated three times so that the researcher could reduce the possibility of being fixated on pre-existing ideas about categories. The card sorts followed the same process as the first. During the second and third card sorts, the researcher proceeded to review the categories to check for overlapping categories or new categories. Initial categories revealed some overlapping, so the researcher made decisions as to whether certain categories could be combined to form a broader category. The researcher consulted with another graduate student as part of the peer debriefing process to help flesh out the categories so that descriptions were more robust. The final card sort yielded a total of 26 categories.

Thematic analysis. After the cards were sorted into categories using the constant comparative method, the researcher looked for similarities amongst the categories to develop emergent themes using thematic analysis (Boyatzis, 1998). Unlike categories, where the descriptions were worded in phrases, the emergent themes were worded in statements of exclusion that differentiated each theme. The researcher consulted with her co-chair to help revise the wording of the emergent themes. Three emergent themes were

identified during this process. They were: 1) an in-depth understanding of mindsketching is necessary for purposeful implementation; 2) mindsketching encourages metacognition, and 3) visual thinking is an integral part of learning.

Trustworthiness

A fundamental element of any qualitative research study is its trustworthiness (Lincoln & Guba, 1985). Establishing trustworthiness in this study was an on-going process. One component of trustworthiness is triangulation. Triangulation is a multi-method approach that strengthens a study to make it credible (Maxwell, 2013). It involves verifying information using multiple sources of evidence (Erlandson et al., 1993; Patton, 2002). The researcher utilized triangulation of multiple data sources by interviewing the teachers and observing them in their respective classrooms. The use of different sources is to cross-reference interview responses with observational data to identify and confirm themes, thereby establishing trustworthiness of the data. The process of triangulation also reduced researcher bias as substantiation of claims was linked to data obtained from multiple sources.

Another component to establish trustworthiness is peer debriefing (Lincoln & Guba, 1985). This component entailed debriefing with peers who were familiar with the research process. The peers included a researcher and one doctoral student, both of whom had background knowledge in the naturalistic research process as well as in mindsketching strategies. Peer debriefing occurred throughout the data analysis phase of the study. The peer also served as a "devil's advocate" (Cresswell, 2007, p. 208) by

asking questions to uncover the researcher's assumptions about the findings and interpretations.

In naturalistic inquiry, the researcher is immersed in abundant data. Patton (2002, p. 406) emphasized that "repressing analytical insights may mean losing them forever, for there's no guarantee they'll return." Thus, the use of reflective memos as a source of information was essential to quality data collection and analysis as they contributed to stimulate and chronicle the researcher's new learnings and understandings. Writing reflective memos in the reflexive journal provided organization to the researcher's generative ideas and validated that the researcher had garnered sufficient evidence to warrant any conclusions drawn (Corbin & Strauss, 2008).

The study utilized member checks at various points during the research to increase trustworthiness by assessing the accuracy of the data and the credibility of the research findings (Lincoln & Guba, 1985). Through member checks, participants were invited to examine transcripts of the interviews to review the content for contextual or content errors, and to clarify queries the researcher may have after classroom observations. Member checks were accomplished by sending the transcripts to the participants via email to obtain corrections and additions. Participants had the choice of either writing their responses or recording their verbal responses.

CHAPTER IV

RESULTS AND ANALYSIS

This chapter is organized into four main sections. The first section presents a description of each participant's story of using mindsketching to build academic literacy in students from poverty. The responses were derived from face-to-face semi-structured interviews with each of the participants (See Appendix A). A pseudonym was assigned to each participant and will be used throughout the rest of this chapter. The participants' stories are presented in alphabetical order according to the pseudonyms.

The second section summarizes data gathered from classroom observations. The purpose of this section is to provide an overall picture of how mindsketching techniques were used by each participant. Classroom observations were vital because they either confirmed or invalidated participants' stories regarding how they specifically used mindsketching. Data from classroom observations are presented using the same pseudonyms and in alphabetical order as in the first section.

The third section provides information obtained from a workshop session where teachers from various schools who were trained in mindsketching worked collaboratively on classroom syllabi incorporating the use of mindsketching across content areas. Data were obtained by observing and listening to teachers as they worked on the curriculum.

Finally, the fourth section describes emergent themes from the participants' stories through interviews and classroom observations. Each participant in the study was unique because they all possessed diverse experiences in their use of mindsketching

techniques. The manner in which they traversed the intricacies of mindsketching techniques into their existing teaching repertoire shaped their individual stories. However, data analysis of their stories revealed similarities, giving rise to the emergent themes and findings in the study.

Participants' Interviews

Beverly. Beverly is in her forties and has taught for 12 years. She has a Bachelor of Arts degree in Business, with a concentration in Human Resource Management. When she felt that teaching was her calling, she decided to pursue a post-baccalaureate and obtained certification as a Pre K-4th generalist from Sul Ross State University in Alpine, Texas. She was later certified in English Language Arts for eighth to twelfth grades. Beverly had been using mindsketching for five years.

When asked about her thoughts on her first mindsketching training, she said she loved it because "I myself always draw a picture in my head." For Beverly, sketching was a strategy that helped her relate to what she learned or read. She explained that everything she read inevitably led to an image in her mind. She provided an example of how she used sketching during her school days to help her remember information. She laughed as she explained the image she conjured for the word *annoying*–"I want to sketch a picture of a boy because I think boys are annoying!"

Beverly found mindsketching especially useful for writing. She felt that teachers were not equipped with skills on how to teach writing to their students. Mindsketching initiated a way for her to teach writing skills because her fourth graders had difficulty sequencing information. She would provide a topic to the class and have the students

first sketch ideas for their stories on sticky notes−one sketch per sticky note. Once they completed the sketches, she would instruct them to sequence their sketches and then share orally with a partner. Beverly pointed out that when the students were engaged in sharing their stories derived from their sketches, they would learn new details from each other, and subsequently, sketched some of those details in more sticky notes. The students would then re-sort their sticky notes until they felt there was a better flow in their stories. This method of sequencing, according to Beverly, has helped her students write more effortlessly.

At the time of the interview, Beverly was working with the students on fable writing. She started off by asking the students to describe and explain their favorite activity. Using the *5 Ws* and *1 H* approach (What, Who, Where, When, Why, and How), the students sketched whatever images that came to their minds on each sticky note. After sketching, they sorted the sticky notes in a coherent sequence. To underscore the importance of sequencing, Beverly shared an anecdote:

> One of the things I would tell them for sequencing is, 'Do you wake up in the morning, throw your pants on and then your [1]*chonies* afterwards?' and they [2][the students] all giggle. I said, 'It's like that when you write the stories.'

In addition to narrative writing, Beverly also used a similar method to teach students expository writing–the only difference was that the students sketched the facts they had learned. She admitted it was a little more daunting than narrative writing, but she observed that the students did improve in both types of writing.

[1] chonies is Spanish slang for "underpants"
[2] Brackets within a quotation denote researcher's own words

Apart from the writing aspect of language arts, Beverly also taught social studies. At the time of the interview, the students were just learning about the coastal regions of the United States. The students sketched images of what they learned on sticky notes which were then placed inside their social studies notebook. As part of their project, the students were going to create an informational pamphlet of the different regions of Texas. The students' sketches served as notes for the pamphlet's write-up.

Beverly noted that the students found it easier to organize their thoughts and write in a more coherent manner when they used mindsketching. However, she emphasized that before any writing activity, the students would share their stories with a partner. Beverley felt that the oral aspect before writing greatly improved her students' ability to write. Another aspect of successful writing, according to Beverly, was that the students were instructed to speak in complete sentences instead of short phrases. She shared:

> This year the sentence structure is going to be extremely important because I have noticed the kids do not want to talk in complete sentences which is going to hurt in the writing, and I have some very shy and quiet and timid kids and I think it is more of a language issue.

Apart from the teacher insisting that students speak in complete sentences, Beverly chuckled and stated, "And you can hear the kids actually correcting each other like, '…you know you have to say it in a complete sentence.'"

Beverly maintained that speaking in complete sentences helped her students write in complete sentences. She explained when she first had her students at fourth

grade, they did not know how to write, let alone express their thoughts in complete sentences. She recalled her experience:

> …in the beginning of the year, their writing is [sic], they do not write in complete sentences. Sometimes it is actually frustrating because they do not write in complete sentences. They are not capitalizing sentences. They are not using their punctuation and their story is all over…

After several months of using mindsketching, she noticed that they wrote more clearly in complete sentences and were actually excited to engage in writing tasks.

Beverly explained how mindsketching also helped in vocabulary, especially academic vocabulary. The students were given a vocabulary word and then they sketched an image when they thought of that word. Beverly recognized that if students did not know what that word meant, they would not have an image in their minds, and therefore, were unable to sketch. In those instances, they were allowed to go to the dictionary, read the definition, and then sketch what they understood from the definition. Afterward, the students would write a key word or essence phrase of that word alongside their sketch. They would then proceed to share their sketches orally with a partner. At the end of the exercise, the students would add on to their sketches and then write their own definitions based on their sketches.

Beverly explained that she used this method of learning vocabulary as part of remediation after school with one of her students. She shared how she used mindsketching during those sessions:

> For her what I am doing is on Tuesdays, we meet after school. We actually do the test kind of together and then we take it and we cut it so she has the word with her sketch and the keyword and the definition separate. And then she goes home and practices in matching the definition with what her picture was and then by Thursday, she is supposed to cut the other ones so she can match her word with her sketch with her keyword with her definition. And then she mixes them up; she made like a little game with it.

As Beverly narrated this incident, she got a little emotional as her eyes teared, but had a wide smile on her face when she finished.

Beverly also shared how mindsketching helped her students write skits based on fables. She related how she encouraged her students draw sketches on sticky notes to help them write skits to perform in class. After school hours, without the teacher's help, the students spent time sketching the content of what they wanted to act out and sequencing the images to tell a cohesive story.

Beverly attributed the success of mindsketching in writing to direct teaching. She spent time teaching students the differences between sketching and drawing, and then training them to do minimal details in sketching. Beverly explained that teachers do not teach writing skills in a conscious manner but simply tell their students to "just write your thoughts on paper." She believed that now that her students knew how to sketch because of constant practice, it helped them to capture their thoughts in images, and then think of how to sequence their thoughts. She reasoned, "…I really think the mind sketching is what is making my kids move from an unorganized [written] piece."

According to Beverly, the training on mindsketching had "truly" impacted her. She smiled as she recalled an occasion during the training where she witnessed for herself the power of mindsketching. The instructor requested a few students to be present at the training so that teachers could see how mindsketching really worked in action. Beverly remembered, "We did pull our worst kids because I wanted to see it [mindsketching] and she [the instructor] did it and when we saw that it worked, it was like, 'wow.'"

When asked to comment on how her use of mindsketching evolved, Beverly shared that her understanding and instructional practice of mindsketching have gone beyond the training she received. She recalled when she first used mindsketching, it was simply a "little game that you would play with the kids, such as sketching things that you see at the park, or things that you see on your way to school." However, now, mindsketching was an important part of her teaching repertoire. She found that it was an essential technique for writing, especially writing summaries and stories, and also for building their vocabulary. Beverly admitted she used to dislike teaching vocabulary as the students would simply memorize and "spit back the definitions." Armed with mindsketching, the students could explain the vocabulary terms "in their own words."

Beverly also noticed a change in her students. Her students, especially the timid ones, were not only speaking up in class more often, but were also speaking in complete sentences. Beverly felt that she has created a safe environment for her students to learn from their mistakes. She explained how the other students no longer laugh at each other's mistakes.

> The language and the way they talk, they do not hear when they do it wrong. It does not click to them even if they are talking but sometimes they will click to their partner and the partner will correct what they say and because it becomes a safe environment because…there is no laughing, no giggling…

Beverly shared how a few of the other teachers in her school did not implement mindsketching into their teaching although they were trained. She felt they did not understand the value of mindsketching and possessed a superficial understanding of how it actually worked. Her comment exemplified that sentiment:

> And she [the instructor] showed us other little games that you could play and I think in the beginning, the teachers were like, 'We do not have time for that game.' It is actually part of their [students'] learning. So, the mindsketching moved from a game to actually being part of their learning…Yes, the ones [teachers] that use it [mindsketching] really believe in it and we love it.

Now that Beverly has experienced the power of mindsketching, she is working on how her students can fully utilize the sketches they have produced. She noticed that once students sketched their images, they were able to remember what they sketched, but after a long period of time, had difficulty recalling what those sketches meant. Beverly now gets her students to keep their sketches and is exploring ways to facilitate students to refer to their sketches for future writing assignments and projects. For example, although her students were trained to sketch very few details, they were allowed to "add a number or letter" to help them remember what that sketch meant to them. Beverly reasoned:

> Certain sketches need more detail than others, especially if they're really complicated words. A couple of weeks ago, we had some really hard vocabulary words and it made me sit down and I try to do whatever they are going to do…So, like I will sketch before I give them my words, I tried to see, can I come up with a sketch on this? And if I can't, okay then we are going to have to work to see all the different things, some kind of pictures that we can do.

Summary of Beverly's interview. Beverly connected to the mindsketching training sessions because she, too, utilized images to help her remember information. As a practitioner of mindsketching, she found the strategy to be particularly useful in writing tasks for her fourth grade students. She believed that teachers had not been trained in how to directly teach students how to write. Thus, mindsketching offered an avenue for teachers to help students write sequentially and in full sentences.

Apart from writing, Beverly was very specific to teach students academic vocabulary, which consisted of words or phrases that students came across in a spectrum of content areas. The dual strategy of mindsketching and adding a key word or phrase to the sketches acted as useful tools for students to remember the meanings of their sketches. The students were also expected to provide their own definitions based on the sketches they had made.

Beverly's use of mindsketching extended outside the borders of her set curriculum. She used mindsketching techniques in a creative manner for remediation purposes. Also, her students, with her encouragement, used mindsketching to help them write out a skit they were working on.

Beverly's use of mindsketching has evolved, from lesson starters or warm-ups, to the actual teaching or reviewing of the content. She now gets students to keep their sketches in a notebook, so they will continue to be a source of help by jogging the students' memory when recalling words or information.

Cheryl. Cheryl is in her forties and had been using mindsketching for four years. She taught first to third grades as well as the fifth grade. She also has a wealth of experience teaching adult classes preparing for their GED (General Education Development) tests. Apart from her teaching experience of 19 years, she served as a curriculum writer for the gifted and talented (GT) program and was also head of the gifted and talented (GT) committee in her school.

At first, Cheryl did not plan to attend the training on mindsketching as she did not want to take one full week away from her family. However, she relented when she realized that the training was tailored specifically for children from poverty. She recalled,

> …my dad and my mom both come from very impoverished homes and I had always noticed my dad is more verbal. My mom is less verbal. So I had always wondered why. What was the difference? And once I learned that, I was like, okay. Something made the difference somewhere and it gave me hope.

Cheryl laughed as she shared that she was still "grumpy" during the training. However, "the light came on" for her when she reflected on her own students' inability to verbalize and express their thoughts. She shed a tear when she shared about her "kids"−going to jail or getting pregnant at a young age. She went on, "You invest in

them. You really love them. And when you see them hurting, you're like, 'Well, then I didn't do my job. I missed somewhere.'" She acknowledged that as she sat through the training, "it gave me hope that I could make a difference finally and I'm not going to be hitting my head against the wall."

When asked about what she understood about mindsketching, she shared her own experience:

> I have an auditory processing disorder so I hear fine but it doesn't process. Like when I'm trying to talk to people, sometimes I can't think of the words. I see it. I know what I want to say but the words don't come out.

Cheryl further explained that she completely thought "in pictures" and that was why she was able to identify with her students. So, to her, it made "perfect sense" to teach mindsketching to her students.

Cheryl first used mindsketching in language arts and writing in first grade, but she has also now included mindsketching in math. For example, she asked students to sketch three-dimensional figures they noticed around the classroom. That was her way of introducing the topic to the students and to surface their prior knowledge. After the sketching activity, the students shared orally what they sketched and why.

Cheryl pointed out that mindsketching was not simply a tool to sketch physical objects. She believed mindsketching was extremely useful for abstract concepts like *addition.* She asked the students, "What do you see when you think of addition? Close your eyes. See addition. What do you see? Whatever it is you see, sketch that on the paper and then tell your partner." She further explained that the power of mindsketching

was not in the sketching itself, but the verbalizing of the concept to a partner. The students were expected to explain why they sketched that particular image.

Cheryl learned that although the sketches seemed meaningless to her, they were meaningful to her students. She explained:

> …Sometimes I'll look at their sketches and I'm like, 'Okay', and then they explain to me the sketch, and it makes perfect sense. But if you looked at it [the sketch], you would be like, 'Forget it. They totally missed the mark.' But they come up with the most ingenious ways of how they thought of it [the sketch] and how they put it together. So I always make sure they do the linking. They have to link it back to what we're learning and it is amazing to see the difference. To me, it's just such a valuable tool to help them see that their thoughts have meaning.

Cheryl also used mindsketching in science with her first graders. They sketched characteristics of mammals, reptiles, or amphibians, and shared the content of their sketches by conversing with a partner. Afterward, the students used the sketches to engage in a writing activity. Cheryl pointed out that her students must share the sketches verbally first before they wrote. While on the subject of sharing orally, Cheryl recalled a "hilarious" incident where she was getting her students prepared for a writing activity. Prior to the activity, the students were not engaged in any mindsketching. She shared:

> When they write, they always sketch before they write. And they know that. And they'll tell me, 'We haven't sketched yet, we can't start writing.' And so, 'Oh yes, you're right. I'm sorry I forgot that step.' So they always know. And it's really cute because they'll say, 'Okay, what do we need to do next? What's my next

> sentence?' And then they go back to their sketch and they'll open it [book of their sketches]. So they know [how] to reference back to their sketch.

In that particular incident, Cheryl found that even when she did not request students to sketch, they still did some mindsketching to help them in the writing process. Mindsketching was a "valuable tool" for them because they needed the images to help them write. Furthermore, Chery noticed they were writing more complex sentences.

Cheryl believed the oral component to mindsketching helped her students "tremendously" in their writing. In their oral exchange with their partners, they spoke in complete and complex sentences. This oral ability manifested in their writing. Cheryl explained:

> I ask them, 'Where is your sentence going to come from?' And at the very beginning, they said, 'Oh well. I don't know.' Well, I said, 'Well, what did you tell your partner?' 'A sentence.' 'Oh, ok, I just shared that with my partner, now I just have to write it down.'

Cheryl shared that mindsketching seemed like such a simple strategy but it has "worked wonders" with her students' writing and sequencing of sentences.

Although Cheryl taught first grade, she explained what she learned at the training sessions on mindsketching with her students. She explained the theory of dual-coding, emphasizing that people learn better with images and that was why they were doing mindsketching constantly in the classroom. Cheryl wanted her students to "understand how to use it [mindsketching] so when they get older, they know what they need to do to be successful." Further, Cheryl introduced the term *schemas* or *units of knowledge* when

discussing with the students about how much they know about a particular topic. She said:

> I don't call it a scheme. I call it their file cabinet. They know they need to be building their file cabinet and that they can go back into their file cabinet to retrieve information. And I explain to them how short-term memory and long-term memory work so that they can understand why it is so important for them to latch it onto something in their file cabinet already because otherwise, it will just go out the door. So I explain all that.

Cheryl found that using mindsketching to sequence a story not only aided her students in their memory but also in comprehension. She would read a story, get her students to sketch, and then the next day, they look at their sketches, or as she puts it, "read their sketches," and share the story to their partner in their own words. That way, she could find out "how good their [students'] memory was and what they remembered."

Cheryl also explained that sharing with a partner was not only crucial for oral language, but helped students to understand that they were accountable to each other's learning. She explained:

> I'll have them divide the paper in half and I'll say, 'Okay, we're going to talk about mammals…Who's going to sketch first?' So you'll sketch one thing about mammals.' I'll say stop and then you're going to tell your partner, 'I sketched this because mammals are blah-blah-blah.' So then your partner will do that. And then you will do that. So they just go back and forth sharing. And the nice thing about that is that it helps jar your memory sometimes. But also, the partner can

> help say, ‘Now, remember? This is what mammals were−Reptiles are cold-blooded. Blah-blah-blah.’ Whatever. So they're kind of a check and balance for each other. Plus, they get bored just doing it by themselves so it's just a way of changing that.

Cheryl shared that academic literacy was more than just “nice vocabulary.” For her, academic literacy was also about learning concepts in school because “…college starts today.” Cheryl reasoned that if students did not understand concepts in math or science, they would face insurmountable obstacles in developing “higher-order thinking” as they went up to the later grades. She admitted that mindsketching concepts was harder in subjects like math, but she found that with practice, the students were able to sketch the concept of *addition* or *subtraction* and explain the sketches in their own words. Cheryl emphasized that indeed, learning had taken place, because the students were not simply rote learning. She elaborated:

> I grew up not knowing math. I mean, it didn't make any sense to me. And so I really want to make sure they understand why. Why does this work? Because then when you then get into calculus and stuff…If you don't understand the why, you're going to be lost. Or like in geometry too, if you don't understand why this relates to this and that and the other, you can't do geometry. So it's really important to me that they understand why. How does it work? Why do we do it this way? So they'll be able to understand the higher-level concepts.

Cheryl shared an anecdote of how she impressed upon her son, who was a freshman in college a couple of years ago, to try out mindsketching in his studies. He

dismissed the idea and said, “Mom, that’s for babies.” Her son faced some challenges in history and had shared his struggles with his professor. Cheryl laughed and exclaimed, “You know what the professor said? ‘Christian, you know what always works for me? After I read the paragraphs I just put like a tiny little picture on the side, it helps me understand.’ I’m like, ‘Who told you that?’”

When asked whether her teaching of mindsketching had changed over the years, she replied she tried “little strategies” not covered in the training. For example, she got the students to “talk to themselves with the sketches” first before they shared orally with a partner. She explained:

> I tell them to sketch and then you talk to yourself, do the same steps but you’re talking to yourself, and that way you can always have someone to talk to. Also I think it’s a good strategy because then, hopefully, in high school and in college, they’ll continue to use the strategy and they’ll know how to use it without having to have a partner.

Apart from talking to themselves, Cheryl felt she grew very accustomed to mindsketching and that it would be difficult not to teach the strategy at all. It was like “breathing air” for her, a strategy that can be used in myriad ways, and each time, she discovered something new about the strategy. She went on:

> Yes, it's just so easy to me, anything that I want them to be able to verbalize and write, it has to be done with mindsketching first. It's just normal now. Before it was like, 'This is so hard, I don't get it, where can I use it? I don't understand' and now I'm so comfortable with it that I don't even think twice about it. Things like

> the activity that I did today with nouns where we had to list things, they're just coming naturally. I don't really have to struggle with it anymore. It's like 'I can use this, I can use that' and so I think this really just took practice to be comfortable with it.

Cheryl is very pleased with the progress of her second graders. She proudly stated that her students could write "4 to 5 sentences, and they're starting to be able to spell and they're more comfortable with writing and they can actually formulate those sentences."

Summary of Cheryl's interview. Cheryl decided to attend the first training on mindsketching because it dealt with how to help students in poverty. As she learned more about mindsketching, she realized it could help her students because they had difficulty verbalizing their thoughts. Mindsketching could possibly provide an avenue for them to speak up in class. Another insight she obtained from the workshop was that she herself thought "in pictures" to help her gather her thoughts, so mindsketching "made sense" as an instructional strategy.

She used mindsketching to surface her students' prior knowledge and before any writing tasks. She felt that the essential component in mindsketching was students verbalizing the sketches to their assigned partners before engaging in writing tasks. She got the students to "talk to the sketches" first before they shared with their partners. As a result of mindsketching, her students could write at least four to five complete sentences because they were trained to verbalize their thoughts in complete sentences.

Cheryl not only taught her students mindsketching, but she also helped them understand how it worked. She explained to them in simple terms what she learned from the training she received, for example, how the brain worked, how having pictures in their minds was so important, and the value of adding new information to what they already knew.

Apart from oral language, she found that her students were able to use the sketches to sequence information. This endeavor helped them to remember stories they read and to understand story plots. Further, the students' sketches helped them remember information they learned from science or math because they were able to sketch the concepts present in those subjects.

A firm believer in having a strong academic foundation right from first grade, Cheryl believed that her students were now excited to learn because they have a tool to help them understand the content. She also believed that mindsketching was a valuable tool that will help them all the way through college.

Deborah. Deborah is in her twenties and had been teaching for eight years. Her experience is teaching the fourth and fifth grade levels. During her career, she received awards such as "Teacher of the Year" in 2009 and the "West Texas Rising Star for Gifted and Talented Education" in 2010. Deborah had been incorporating mindsketching strategies for five years in language arts, history, and social studies.

Unlike the other participants, Deborah attended the training on mindsketching on her "own free will" as she was "intrigued." She shared that she used to draw pictures in her notebook when she was in college. She recalled:

> I just drew figures to re-enact the text from [sic] revolution. How funny! And especially because it was something that was a lot faster my brain could not communicate the words quickly onto the pencil. Instead I visualized the professor's words and I immediately had to draw all that picture. So when we were first introduced to MS [mindsketching] I thought, 'Wow!' I was in fact not crazy for drawing notes. This is great! I was intrigued because it was something that I connected to.

For Deborah, mindsketching was simply about "creating a visual." She reiterated that the sketches were more than simplistic diagrams. They were "visual notes" to help her remember key information. Therefore, the sketches had to be meaningful for her long after she made them. They acted as triggers to recall information.

When asked how she first taught mindsketching to her fourth and fifth grade students, Deborah replied that at first, she taught the strategy the way it was introduced at the training. First the students had to draw a house with as many details as possible. Their partners would look at the drawing and describe the details. Then, the students would be told to erase as many lines as possible so that they were left with very minimal lines. The eventual sketch would not look anything like the initial house they had drawn, so it would appear meaningless to the partner, but meaningful only to the producer of the sketch. However, after a couple of years of using mindsketching, Deborah decided to be "a little bit more creative" by projecting pictures from an Animalia book onto a screen to get students to identify as many objects as they could and draw them. Then, the students

would erase as many details as they could. After sketching, the students would describe their sketches to an assigned partner.

Deborah also shared that sometimes, while the students drew from the Animalia book, some of the students were not able to identify the pictures. She described the situation:

> And if they didn't understand it, then we'd discuss it. There were some times when I would tell the kids, 'I didn't even know what this was. Did you all know what this was?'… Well, we would have a small discussion. So we would have that learning experience together and so they would feel a little more comfortable.

When asked about the purpose of drawing diagrams from the projected images, she replied that she wanted the students to get the feel of drawing details first, and then go through the process of erasing lines, so that they explicitly understood mindsketching. At first, she thought the students would prefer drawing to sketching, but she expressed her surprise when she discovered that the students actually liked sketching because what they created "belonged to them." Deborah felt that this sense of ownership was what made mindsketching meaningful to the students.

One of the ways Deborah used mindsketching was to help students take notes in her history class. She provided an example of the Texas Revolution. She explained that she found this topic difficult to teach because "there were many little battles" to describe and remember. She explained in detail how she used mindsketching to teach the Texas Revolution:

> We first wrote down Texas Revolutionary War and then underneath it we sketched each battle individually and then maybe the little scenarios that went along with that battle underneath it. Because for the kids, it's like, Ms. Deborah, there are so many names for us to remember. How do we remember every single battle, you know, how is it important to us?' So what we would do is that, one thing I have learned about mindsketching that really helped me, is we act it. So we talk. I added acting [role-play] especially in my history. Yes, we had to act it for them to actually have the connection.

When asked to clarify how role-playing and mindsketching helped the students to remember the content, Deborah explained that if it was only sketches, they understood the words but did not have anything to connect with that information. The role-playing, she felt, helped them to make that connection. Deborah provided an illustration of one of her lessons to explain how her students connected mindsketching with role-playing when they were tested on this topic:

> It [Independence of Texas] was very abstract for them and they needed the acting in the concrete. And I know that they were understanding [sic] in the concepts …We had another assignment where they had to write about something new about Texas this year, and they were able to look back at their notes. Some of them didn't even look at their notes and they wrote beautiful papers because they remembered the acting. Those that used their sketches, you know, they were like, 'Oh I remember, that's right, Taylor was the Mexican soldier' and they were making the connections to students and that connected to them. So they were

able to write these papers using the vocabulary that they learned. And the names too, which was surprising.

Deborah further explained that apart from the students being able to recall what they learned, the overall objective of mindsketching was to write. She said:

> Yes, history, I think that is usually the most difficult for the students. But then, to be able to take that history lesson and then transfer it over to a type of writing, that was what made it. Because to me, for the students to be able to then turn their sketches to writing is a goal of mine…

Another writing activity where mindsketching helped was narrative writing. Deborah explained that the "think-sketch-sort-talk" activity helped her students to articulate orally and then engage in a writing activity. Deborah described this activity:

> …and my favorite is think-sketch-sort-talk-write. And that's the one where they would think of many things they could see, eh, a carnival and then sketch them …And then they remove the ones that they were probably not interested in, and then they were only left with three sketches. They had their conversation with their partner about those three sketches in an order that they wanted to…and I challenge them, 'Ok now I want you to use very descriptive words when you are talking about your sketches' or I'll say, 'I want you to use a lot of action words, focus on your actions this time.' So then, whenever they were doing that they were having that conversation and it's, I'd say, 'Okay, now move your sketches one underneath the other and you're gonna write exactly what you told your partner.'

Deborah explained that she used this same strategy as a pre-writing activity to get students to focus on descriptive words, nouns, or action words. The students would share with their partners and then, the actual writing activity would be on another topic, but using the same idea. To encourage her students to write, Deborah stated that her mantra was, "Write exactly what you told your partner" so that her students would not be intimidated by the writing process.

Deborah shared her favorite homework activity right from the first day of school. She described what the students had to do as homework:

> And I say, 'Well the only homework you have is you take this brown bag back home and you have to sketch three things that would, that you can put in this brown bag that would tell me about you.' It serves so many purposes because we're getting to know them. They're in the concept of mindsketching, then they don't know it yet, but then we put them in order, and guess what? They're gonna write. But they're excited to write about them. Which is what I want them to do is to first connect sketching into something that will always be a connection with them. And, they'll order it, they'll talk about it, we work on our very first composition, and that's our very first one, and then that's when we put out our paragraphs, our very focused paragraphs…

Deborah shared that although she did not teach math, her students came up to her excitedly and told her that they also sketched "little pictures to help them" in their word problems. Although their math teacher did not use mindsketching, the students found a way to use it in another subject. For Deborah, the fact that they used it in math showed

that her students were able to apply the strategy in another subject because they understood how it worked.

Another area that Deborah used mindsketching was vocabulary. She shared that she disliked students simply copying definitions of words from the dictionary because they memorized the definitions without understanding what they meant. Instead of copying the definitions, Deborah used vocabulary words from the children's version of the Scholastic Achievement Test (SAT) which already had pictures with the words. The students were required to "sketch the definition that they see in their mind [sic] next to it…" Deborah explained that the students used the pictures provided to not only sketch what "they see in their minds" but to also come up with "the key or essence phrase or word that will trigger them if they don't remember what their sketch was…" She also shared that instead of spelling tests, the students focused on building their vocabulary. She elaborated:

> …and we would have quizzes. And there what I would do is I would cut off the word. We would cut off the key phrase and all the students were left with was the sketch and I allowed them to use only sketches on the test, so I did allow them to use that…

Deborah shared more about how she utilized the students' sketches. When she was newly trained in mindsketching, the students sketched for a particular lesson and then discarded the sketches once the lesson was over. However, she believed that there was value in keeping the sketches on a long-term basis because the students could still

refer to the sketches if they needed help in understanding what they learned previously. She explained:

> We're gonna not sketch details but we're gonna sketch enough details to where we'll remember what it means because I had some students that would only sketch a triangle at first, and they'll say, 'Oh I remember it' and they're like, 'I don't know why I sketched a triangle.' Well, remember the sketches have enough details so they start to say, 'Okay, I'll need enough but not too many where I can tell, you know, what it is, it's for you.'…And then what they would do is they would, they have a notebook where they have their word, their sketch, they would reattach it and then the key phrase part so their little notebook has vocabulary. And then what we would do with that notebook is we would go back to the sketches for their writing.

Deborah also used mindsketching to review previously learned material. During her most recent lesson, the students completed a topic on fairy tales. To help the students review what they learned, she told them to sketch "as many things as you can think of that have to deal with fairy tales." The students used the sentence prompt, "When I think of fairy tales, I know there is a [blank]." By way of an example, Deborah mentioned that one student sketched a crown because when he thought of fairy tales, there was royalty involved. For Deborah, reviewing previous knowledge using mindsketching was akin to a "healthy competition" because every student was talking and the students were motivated to speak in complete sentences. To challenge the students, Deborah provided

three random letters of the alphabet, and the students sketched something connected to that letter. Deborah provided an example:

> So let's say what we did for our fables we had a quiz. I said you need to sketch for me using the letters *A, B,* and *C,* three things about fables that were important to you. So, Aesop [using the letter *A*] he was a slave 3 000 years ago and *B* there was a boar and this was his character. So they had to come up to me after their sketch and tell me about it and that was our quiz for that.

Deborah emphasized that in all the activities involving mindsketching, there must be oral sharing between student partners because this was the best way to test if students really understood what they were sketching. Deborah did come across situations where some students wanted to take some aspects of their partners' sketch and add on to their own sketches as it helped them to remember better. She allowed that process to happen as long as the sketch was meaningful to them.

Deborah felt that the biggest benefit her students enjoyed was they were engaged in productive oral language. As a result, they wrote better because the sketches helped them to "refocus" as they wrote. Deborah was gratified to see her students speak in complete sentences, being confident of themselves, and trying to practice speaking in complete sentences at home. She said,

> They were practicing the talking at home. I say, 'Guys, get your planners, sketch three things that you learned today or sketch three things that you remembered today that we have learned so far, go home and talk about it.' And so I get students who come back and tell me, 'Ms. Deborah, I told my parents but they

didn't know what I was talking about.' So I did have a lot of that but I said, 'That's okay guys, as long as you're talking to them that's good.'…I saw parents now becoming more involved in their academics. Parents are also now more involved in projects too because it's like wow, they now know what is going on in school. There's now that communication between school and home and they're coming home and they're seeing their son or daughter talking about it every day.

Summary of Deborah's interview. Deborah voluntarily attended the first training on mindsketching because she was curious about the strategy. She considered mindsketching as a form of "visual notes." For Deborah, mindsketching was a productive strategy to remember key information.

During mindsketching activities, Deborah instructed her fourth grade students to experience drawing diagrams with details first. The students then went through the process of erasing extraneous lines in their diagrams resulting in sketches. Deborah felt that this tactile process of erasing details was what helped students understand what a sketch ought to look like. Further, her students developed a sense of ownership of the sketches they created as the sketches were only meaningful to the ones who produced them.

Deborah included other activities and resources such as role-playing or picture stimuli to help her students engage in mindsketching more effectively. Therefore, mindsketching was not a stand-alone strategy but incorporated seamlessly into other routine learning activities.

Deborah's teaching subjects such as language arts, history, and social studies, demanded a great deal of writing from the students. Therefore, her main objective of students engaged in mindsketching was for them to write with ease and remember key information from the sketches they created.

One challenge Deborah surfaced was how to get students to remember what their sketches meant to them after a long period of time. She opined that over the course of time, the students should be able to refer to their sketches when reviewing content. She experienced some success when students kept the sketches in their notebooks and used them for quizzes and tests.

Apart from students now being confident and speaking in complete sentences, Deborah was also gratified to note that her students used mindsketching in math, a subject she did not teach. Although the math teacher did not use mindsketching in her teaching, Deborah's students discovered that the strategy worked for them in tackling word problems. Also, with Deborah's encouragement, her students were motivated to practice speaking in complete sentences at home.

Helen. Helen is 45 years old and had been teaching first to sixth grades for 17 years. She has a degree in finance from the University of Texas in El Paso and a Master's degree in multicultural education from the College of Santa Fe. During her teaching career, Helen was a Literacy Leader and a Coordinator for "Success for all Reading" program for grades K-5th for four years. She had been using mindsketching for five years.

When Helen was asked to attend a training on mindsketching, she admitted her initial feelings were not very positive. She asserted, "…it's probably another training, I've been there, I've done that, I've heard the same thing over and over again in so many different ways." But what changed her impression was the information about children from poverty and how mindsketching could open doors to help her students learn. At this point, she said she could not contain her enthusiasm. She explained:

> It's just like the light bulb turned on and I was like, 'I never saw it that way' or 'I never understood that.' Yes, yes, it made sense. I literally, when I go to training, look, every single thing trained I go through, I have to write down everything.

At this juncture, Helen went to her table and brought two thick notebooks with typed notes taken during the training on midsketching. She always ket them at ther table so she had easy access to them. She explained:

> I really, really write a lot of notes, that's why I really wanted to type it [sic] out and I like to type things so I can remember, that's why I did the cheat sheets, because I know that there's so much going on and I look at my cheats and, this is perfect. They are there on my table so I can be sure I'm using mindsketching on a daily basis, you know, sort of give me ideas.

Helen then picked up a science notebook belonging to a student she was working with. He had difficulty verbalizing his thoughts about *large* and *small*. Helen showed his sketches and explained:

> See? This is him trying to sketch the picture or even just doing a quick sketch of which is larger or smaller. This is a tree and this is a butterfly. He was able to

> verbalize it to me, like a tree is larger than a butterfly. And this was an ant [that] is smaller than a ladybug. He verbalized it to me, but for him to even just do something was good.

She further elaborated on the lesson:

> This is what we were doing. We took a walk around the school, I said, 'I want you to look around, look at things that are larger, things that are smaller. Keep them in your brain' and I said, 'we're not going to use our mouths, we're going to use our what? Our eyes.'…I thought he did pretty good, and as you can see he was really good at his sketches. When I asked him, he was able to verbalize.

This particular student had been in her class for only a week. Within that time period, Helen saw tremendous improvement in his oral language. Her experience with this student helped her to understand that the key to mindsketching was getting students to verbalize their thoughts. She contended that despite her students' inability to write well, they were able to speak in complete sentences. Helen viewed mindsketching as "a crutch for verbalizing."

When asked about what mindsketching meant to her personally, Helen shared her thoughts about how we are all "visual" by nature:

> I know that people, they don't have to just hear it; they have to actually see it. We have so many perspectives, so many different background knowledge, so much different schema, so many different points of view. I think that mindsketching centers it more to maybe one perspective, maybe one point of view because we all see things differently, even like the trainings, we're going to

> perceive things differently, we're going to see them differently based on our experiences, on what we've done in the past and I think for me mindsketching makes it a little bit more focused to me, a sort of having a shared understanding.

Helen shared how she used mindsketching in reading for second grade. She would read the first paragraph from a story and the students would sketch what they listened in less than 20 seconds. She would then read the next paragraph and the students would sketch. After 4 or 5 sketches, the students would turn to their partner, point at their sketches and share the sequence of the story orally. Helen shared that the students were able to sketch very quickly, but more importantly, recited the story in their own words in complete sentences. Helen's strategy was to work with them on verbalizing more in class and then work on their writing.

Apart from reading, Helen also excitedly shared about how she experienced success using mindsketching in math and how she was amazed at the students' fairly quick understanding of math concepts. She shared:

> I had to introduce multiplication and I taught them division in second grade by January, because the standards went up. And I was like, 'I have never done division in second grade.' They [the students] weren't understanding how multiplication was the opposite of division. So…they would sketch the multiplication problem and they would see that when you're doing the multiplication problem, you're putting them in groups, you're counting them in groups, but when you do the division problem, you have the whole group and

> then you're breaking it down. So I think it helped them see the difference between multiplication and division…

Helen also used manipulatives to help her students understand math concepts. Mindsketching was first done to extract a certain concept, so she asked the students, "See in your mind one quarter. Okay, now sketch it." Then, she used manipulatives to help the students see the concept in action. She explained, "the perfect example that works really well is a Hershey's bar, you know how it has the fractional parts, and they also get to enjoy that of course."

Helen used mindsketching to surface prior knowledge. She showed a cut-out silhouette of a person's head. Helen used the silhouette numerous times for students to sketch what was "in their heads." She provided an example of introducing fractions to her second grade class. She told her students:

> 'What is a fraction to you?…I want you to sketch 5 things that are in your head,' and then they sketch them, and if they have any background knowledge it also helps you to see what they know ... sometimes I see that there's many misconceptions as to what they think it is and then sometimes some of them of course already know, so it tells me what they're coming up with.

Helen also utilized mindsketching techniques in science. "There's a lot of opportunities to sketch, almost everything is about sketching!" she exclaimed. When she engaged her students in nature walks, she encouraged them to use their senses to sketch what they saw, felt, or heard. Helen also shared about teaching concepts like *movement*. She had students think about and sketch things that rolled, slid, or spun. Then she would

ask them to sketch the differences between those movements and talk to their partners using their sketches.

Helen found that teaching sequences such as the life cycle of a plant or water cycle, was especially effective when students sketched the various stages. The students sketched each stage using sticky notes and explained the whole cycle to their partner in complete sentences. She also used mindsketching as a form of review, so she had students mix up their sketches and then re-order them.

When asked how her mindsketching strategies changed over the years, Helen stated that she found more opportunities to use mindsketching. At first, she used mindsketching as an introduction to the lesson, but now, found several ways to embed the strategies seamlessly into the lesson. Also, Helen managed to adapt the use of mindsketching to individual students. For some students, they needed more sketches to help them articulate their thoughts while others did not sketch as many because they were already comfortable verbalizing in complete and complex sentences. Helen also shared an anecdote where students competed with each other in trying to come up with long and complex sentences. She said:

> It was funny, yesterday it was funny because that's one thing we discussed in yesterday's lesson. One of the girls was saying, 'Mrs. Helen, he's saying too much' because some of them were going on and on and on and on, and I was like, 'remember, the person that hears you needs to repeat it, okay? So let's think of one thought, let's stick to one thought only.'

Overall, Helen was very happy with the progress of her second graders. She did not see any challenges in incorporating mindsketching in her teaching arsenal. She shared she would be working on vocabulary over the next few weeks to ensure that the students write better and more fluently. She ended the interview by saying:

> Once these kids are able to verbalize, never mind if they are using mindsketching less and less, but at least that is the crutch that they have. I mean, that's the whole idea, to get them to talk. So, it's consistency, consistency, consistency, in using mindsketching.

Summary of Helen's interview. At first, Helen was quite resistant in attending the first mindsketching training because she had been to so many professional development programs and felt there was nothing new she could learn. However, as the session progressed, she realized that mindsketching could possibly help her students from poverty. At that point, she needed to understand how mindsketching could work in her classroom. According to Helen, we are all visual learners and therefore, mindsketching was an extension of what we already do naturally.

After attending several training sessions on mindsketching, Helen decided to compile all her notes and learnings into notebooks so that these resources were easily accessible if she needed to use mindsketching in various ways. She committed herself to use those resources as much as she could in her lessons and practice what she learned at the mindsketching training sessions.

Helen used mindsketching in a variety of subjects, such as science, math, and reading in her second grade classroom. In science and math, students sketched the

concepts they studied. For reading, they made sketches to help them remember the details of the story, but more importantly, to recite the stories in their own words.

To surface her students' previous knowledge on a particular topic, they used paper cut-outs depicting silhouettes of heads to sketch their ideas. Helen found that surfacing prior knowledge was vital in establishing her students' level of content knowledge. Further, mindsketching helped her to clear misconceptions that the students may have on a topic or subject under study. She found that her students enjoyed sketching their ideas on the cut-outs and then explaining what they already knew about the topic they were about to learn.

When Helen was newly trained in mindsketching, she used the strategy only at the beginning of the lesson. Now that she was comfortable with the strategy, she used it at every point of the lesson when she felt her students needed to use it. As a result, her students were more vocal in class; speaking in complete and more complex sentences.

Rosalind. Amongst all the participants, Rosalind is the newest in the teaching profession. She had been teaching for five years, and during her whole teaching career, she had been using mindsketching. She has taught fifth and sixth grades. Despite her relatively short teaching career, she, together with a group of other teachers, presented a concurrent session on how they used mindsketching in their classrooms at a professional conference in Texas four years prior.

Rosalind shared that the training on mindsketching was mandatory. The training was on its second year but it was her first year of teaching at "a campus that I was not

excited to be at." When asked why, Rosalind replied that she wanted to work at a school nearer her home, so she was a little frustrated to be so far away from her young daughter.

Moreover, during the training on mindsketching, she was rather skeptical. She shared, "…then she [the instructor] did the sketching and I thought, 'Well that's a doodle. I'm not sure this is going to change the world.' Although she did not have that "initial buy-in," she explained how she used sketching to take notes while in college. She recollected:

> It actually triggered memories in my own note-taking in college and in high school because I'm very visual. My own binders and notes, that I would get in trouble for because they weren't neat enough, were filled with doodles and random bits and pieces on the edges. Once she [the instructor] started talking, the more I realized that that's what I had been doing all along. So it made it much easier for me to be able to understand how it could be used in the classroom.

In a joking manner, Rosalind stated that mindsketching "is a fancy name for a doodle." On a more serious note, however, she took some time to think about what mindsketching meant to her personally. After some time of pondering, she stated, "it [mindsketching] makes abstract thinking concrete. It's a way to reflect your learning…a tool that allows both the teachers and the students to explore and demonstrate their understanding."

Rosalind shared that when she was learning to incorporate mindsketching into her teaching strategies for her fifth graders, she had no problem getting students to sketch. The teacher who taught the previous grade had already used mindsketching, so

when the students went up to fifth grade, Rosalind simply did a refresher lesson on mindsketching with her students. She recounted:

> I'll tell them, 'Sketch as many things with wheels as you can' and I'll give them the time. And then I'll look and I'll say, 'It looks to me like we need a refresher on what a sketch is and what a drawing is.' And then we go back into the basic [sic]. 'If I were to ask you to draw a picture of your house, what would you draw? And if I were to ask you to erase all the unnecessary lines?'…I had a dry erase board on the wall in my room so we've actually done that. Anyone who wants to draw on the board can draw on the board. And then we reduce it down to a sketch…

Rosalind found that having students who already had some basic understanding of mindsketching helped because she did not need to spend time re-teaching the strategy. She admitted that she used mindsketching regularly in language arts only, but wanted to extend her use of mindsketching into other content areas such as math and science. So, it was really useful for her when the students already possessed some knowledge of mindsketching so she could "stretch the students."

Rosalind shared how she used role-play to teach math concepts. She found that mindsketching was a natural "add-on" to what she normally did in class. She explained:

> I was starting with place values and I was trying to think how can I make this more concrete? Because the kids who don't understand place value, they see that the numbers go in order but they really don't understand why the lower numbers are on the right and the higher numbers are on the left, and that it's more of a

> matter of a greater value or it having more power and so, I didn't start with a sketch. We started with an activity and we had a kindergarten chair and a regular elementary school-sized chair and then the teacher's chair that has the little foamy cushion with some rollers on it. It's not very nice but it's the teacher chair and then the principal's larger chair and then we put them in order and I said, 'Now if I had to tell you which person has the least amount of power in the school, who would you say it is?' And the kids said, 'Oh! It has to be the kindergartener." And then from there we moved up through the ranks. And they [the students] said, 'Well [3]Mr. Harris has the most power so he has the nicest chair.'

Rosalind then told the students to sketch their understanding of place values but they were not allowed to use numbers. She pointed out that the students did not all sketch chairs but they had their "own little images" which they explained to their peers. One student explained that his sketch was about his experiences being the youngest in the family so he had hand-me downs. So according to this child, he had the least "power." Rosalind explained that this experience was typical of her students because most of them came from "…huge families and they wear hand-me downs…"

Another math lesson where Rosalind used role-play was on the topic of fractions. She had the students act out *one quarter* and the students used "their bodies and their friends" to make a quarter. Rosalind pointed out that acting and role-playing were concrete actions to describe an abstract concept like one quarter. She explained:

[3] Mr. Harris is the principal of the school. This is not his real name.

> Acting and role-playing…seemed to work better because when I tried to start with, 'Can you come up with a creative way without using any numbers to show me one fourth?' I got a lot of dot matrix type things, but that didn't always mean that they understood it…When they [the students] did the physical part and then sketch, they always seemed to understand a concept better…

In science, Rosalind tried a different approach. The topic was *matter* and she used mindsketching to help her students understand the topic in a different way. She provided a typed text about matter. The students read in pairs and, instead of getting students to sketch what they understood, she had the students explain what they read to their partners in their own words. As for the definitions, Rosalind noted:

> So we went back and as a class, we reviewed the academic definitions and I said, 'Is there a way of saying what's in the definition without using any of the words in the definition?' And then they [the students] said, 'I can't use the word neutron?' I said, 'No you can't use that word neutron.' And they said, 'Can I use the word particle?' 'No, you can't use the word particle' and so that forced them to have to come up with synonyms. And some of them actually went and found antonyms. It's the opposite of something really big and because they've been doing this all year with me, they were pretty good. And then once they had discussed it then they were allowed to go back and sketch…

Rosalind explained that she was able to detect students' gaps in understanding because they had to "sketch and explain it to someone who didn't understand it." She reiterated that sketching was highly useful in combination with students verbalizing their

sketches. She also explained that the students' sketches were "…really useful because some of the students can't remember the definition but they can remember what they sketched."

Rosalind used mindsketching regularly for review, where her students had to recall what they learned about matter by sketching. She went on:

> I loved this [mindsketching] for review…I would give them a concept that we had covered in science, like the properties of matter, and I would say, 'I would like you to come up with all the things you can remember about the properties of matter we've covered in the last 3 weeks. And you'll take turns sketching and you can talk as you sketch or you can wait until after you've finished sketching.'

After the students shared in pairs, they did a "whole class share" where they were encouraged to fill in other details that most of the students had missed out. The activity normally culminated in a writing activity. By this time, Rosalind found students were ready to write and did not seem to dread any writing task that was given to them.

Rosalind also excitedly shared about how students were now able to understand the intricacies of plot development using mindsketching. She felt the students' sketches provided an avenue for them to delve more deeply into the character of the protagonist, or how the plot developed into a climax. She shared how the class would do "a plot mountain" where, instead of using words to describe how the story reached the climax, they used their sketches instead. Rosalind found that her students did more than simply narrate the story; they also talked about narrative devices that were used to move the plot along.

Rosalind confessed that she constanly struggled with vocabulary lessons. She explained that she did not have set lists of vocabulary words for the students to learn. However, this situation turned out better for her because whenever the students came across a word they did not understand, they sketched what little they did understand, checked the dictionary, and made another sketch to explain what that word meant. The sketches, done on sticky notes, went into their word journals. Rosalind referred to the word journal as a place to "read their sketches."

Increasingly, Rosalind noted that her students now saw connections of vocabulary words they learned in different content subjects. She explained:

> I had a student who realized, because we'd talked about Switzerland remaining neutral in social studies, and then in science, the neutron did not have a positive or a negative charge, and one of the kids actually made that connection.

Rosalind shared that before, her students were "very compartmentalized" and "…think that what they learn in science does not bleed into math, does not bleed into social studies." However, the word journal with the sketches helped them to connect many of the vocabulary words they learned in a variety of contexts and meanings. Rosalind, at this juncture, gave a wide smile and said she was very happy with how her students were progressing.

Another area that she used to grapple with was the issue of plagiarism. Whenever her students worked on their projects, they used to take "large chunks of information" from books or the internet and simply insert the information without understanding the content. She described how plagiarism was an issue with a teacher friend of hers:

> I have a friend who's doing the same biographies that my students are working on now and her complaint is that they don't know how not to, they can't avoid plagiarism. She says, 'It does not matter what I do, they really are not understanding the words need to come from them and they're not understanding the research.'

Now that Rosalind's students use mindsketching, they no longer plagiarize information because they are not allowed to write notes when they sketch, and only after they verbalize the sketch in their own words are they allowed to write three or four words to highlight the essence of the meaning of each sketch. According to Rosalind, her students' research "is much more solid because the sketches are triggering the knowledge."

When asked how her mindsketching strategies evolved from the first time she started using them, she replied that she used it so often and incorporated mindsketching seamlessly into her teaching. More importantly, she found that her students used mindsketching even without being told to sketch. She said:

> I also have learned to appeal to their natural laziness. I say, 'Well why would you want to say that with 12 words when you could say it with one sketch that you can do in two seconds?' And so, it's integrated more into the curriculum whereas I really had to think about how I was going to use it. It would be a very specific moment of the day, 'Okay now we're going to write a sketch.' And now we just do it. That's just a part, we will include the sketch and they don't even ask anymore, 'Do we have to do a sketch?'

Summary of Rosalind's interview. Rosalind attended the training on mindsketching because it was mandatory. During the training, she remained skeptical as she did not think that mindsketching could help her students. However, as she reflected on her college days, she remembered making diagrams along with her notes to help her understand the content better.

For Rosalind, mindsketching was a strategy to help "explore and demonstrate understanding." It was a way to make abstract concepts seem concrete because the concept was captured on paper. Because of her experience in making diagrams in her notes during her college days, Rosalind was able to see the connection between her early experiences and mindsketching.

With her fifth graders, Rosalind was fortunate in that her students had already learned mindsketching in fourth grade. She did not have to re-train the students, but simply afforded them more opportunities to use the strategy. Thus, Rosalind extended her use of mindsketching from language arts to math and science.

Before the use of mindsketching, Rosalind enjoyed incorporating role-play to introduce a concept. When mindsketching was integrated into her role-play activities, she found that students understood the concept more easily. When students witnessed an abstract concept "acted out" in concrete terms, the students sketched what they saw to help them remember.

Rosalind also used mindsketching as a review of the content learned as well as getting students to understand plot development in narrative writing. She noted that

when students were engaged orally after mindsketching, they were able to go deeper into the topic because the sketches served as a springboard to their oral discourse.

Since using mindsketching, Rosalind found that students were able to see connections in various content areas and were not so compartmentalized in their thinking. She also found that issues with plagiarism reduced because students verbalized the sketches in their own words and then wrote them out in complete sentences. As a result, Rosalind was more convinced that her students understood what they learned because they were no longer engaged in rote learning.

Tina. Tina is in her fifties and graduated with honors from Purdue University. She had been teaching for 18 years and used mindsketching for four years in her second and fifth grade classes. She was voted '\"Teacher of the Year" in her school in 2002.

Tina taught fifth graders history and social studies at the time of the interview. Throughout the interview, she was very animated and excited about sharing her experiences with mindsketching. Tina attended training on mindsketching because she worked with fifth graders who had low verbal scores after they were tested using the Reynolds Intellectual Assessment Scales (RIAS). She taught second grade for about 16 years, so she welcomed the opportunity to learn something new to help her fifth graders.

"I immediately felt goose bumps at the power of mindsketching," Tina said as she recalled her first training workshop. She felt that mindsketching was the answer to her students' "language deficits." She dubbed her students as the "silent children" because they were highly disengaged in classroom activities. Tina explained that right from the beginning of the training, she knew that mindsketching was a "core" strategy to

help her students express themselves verbally. As Tina put it, “It’s like watching someone show you a way to tie your shoe that's infinitely better.”

When asked about her understanding of mindsketching, Tina said, “It’s just capturing that snapshot in your mind.” She explained that when one is reading or listening, pictures form in the mind−a “mind movie.” She further elaborated:

> In our reading lessons, we constantly stop in our reading and I say to the students, ‘Okay, do you have your mind movie? Do you have it right now?’ Because once it stops, you have no picture in your head. Then that means you’re disconnected, you’re unplugged, you need to raise your hand and you need to stop me in that moment once you don’t have that picture.’

Tina told her students that they would need to have “that picture in the brain” if they understood what they learned. According to Tina, if students did not have that “mind movie,” that was a signal for her that they were lost, that they probably did not understand what they read or heard. That was when they had to quickly “get back on the train.”

Tina was very comfortable with mindsketching and used it a great deal as an assessment tool. She explained:

> It [Mindsketching] became much more of an assessment tool than it had been in previous years because I could tell right away who has that concept…If you’re trying to mindsketch an idea, it becomes very apparent if you’ve got nothing. If your mind is blank and you’ve got nothing, then you need to still be studying that area…It’s black and white. They got it or they don’t.

Tina described in detail how she used mindsketching when assessing students' understanding of certain topics covered in social studies. She used some letters of the alphabet for students to make connections with what they learned. In addition to the letters, students had a sentence prompt to help them speak in complete sentences. Students sketched and wrote what it was on a blank sheet of paper. Tina provided an example of this process:

> So let's say, I've got the letter *T*, so I say, '*T* is for Civil War because… and I say, put in your mindsketch…So the student will probably say, *T* is for Civil War because they dug trenches or whatever…So, the students will sketch first and then write on the back of the paper.

Tina also explained that during the assessment, she allowed students to come up with two ideas–"one that is common, like the trenches and another uncommon idea…" that only few students might produce. She also mentioned that increasingly, she found herself posing the following question to her students, "Was there a letter that you were infinitely angry it wasn't in this graphic?" Tina laughed and explained that she had students who wanted to sketch an unusual idea that they felt other students did not have but they were not provided that particular letter by the teacher. Tina further reiterated that the sketch "must come first before they write" as the "graphic [sketch] supports the writing." She also pointed out that students sketched and then wrote out their responses during such assessments. Most of the time, the students sketched, shared orally, and then engaged in writing activities after the oral sharing.

Tina also used mindsketching to surface prior knowledge. On the topic of the Civil War, she asked students to sketch 8 to 10 things that they knew about the topic. According to Tina, "…the child that can come up with three things doesn't have a lot of background knowledge…" Surfacing previous knowledge was important to Tina because it helped her structure her lesson in a way that allowed students to connect with what they were going to learn to what they already knew.

Since novels constituted a large portion of the reading in Tina's language arts class, she used mindsketching for a variety of purposes. One of them was to study the novel's characters. Tina found that understanding characterization posed a challenge for the majority of her students. However, Tina maintained that mindsketching helped her students to explore the depth of characters in a novel. Tina explained:

> I use it [mindsketching] a lot in conjunction with the elements of depth and complexity…They lend themselves beautifully to mindsketching. So you might, let's say, we've gone into something in the second or the third chapter of the book. We're kind of seeing where the plot is going. I might say, 'Okay, you've got your protagonist. I want you to mindsketch the details.' And they're going to hold that little image for details. 'You're going to mindsketch the details that you think are the most important things to remember about your protagonist, your antagonist. Who are the main characters? Just quickly sketch it out. What do you need to know?' And in [sic] the most powerful part of that, for beginning something… is to talk.

Another way mindsketching was used in novels was reading for understanding. When reading novels with the students, Tina felt that teachers, on the whole, paused at certain times and would merely "throw out a question" to students, or provide brief synopses of what was going on in the story. The teacher had no way of knowing whether the students were following the plot. However, with mindsketching, Tina noted that students were not only able to recall the highlights of the story, they could provide their own predictions on what would happen next. For Tina, to be able to infer was one of the hallmarks of academic literacy. Tina explained that "…if you pause a little bit more and if you'll have them quickly sketch and then share…," the students are engaged in "academic language" with each other. Furthermore, when they came across words they did not understand like *trudge*, Tina used actions and contextual clues in the story to help them sketch instead of relying on the dictionary for the meaning.

In terms of being able to sequence events, Tina recalled that she was "…shocked at how difficult that is for some kids…" They already had difficulty putting their thoughts on paper, and for them to be able to sequence events or highlights was a huge obstacle to their learning and their ability to remember information. Tina joked that her "best friends were sticky notes." As the students read a novel, they sketched images after every paragraph onto their sticky notes. After a few days, they scrambled the sticky notes and then sequenced them according to the story, after which, they orally shared the story in their own words to their partners. Tina believed that mindsketching was an important "speech prompter" because students were always expected to share with each other using complete sentences.

When asked how her use of mindsketching changed over the years, Tina smiled and said, “It just feels so seamless…it’s more like a flow…” When asked to explain, Tina laughed, “I used to have to put these strategies in my lesson plan, you know, when to use them and what not…” But now that she felt she was competent in mindsketching, she simply “plugs it in” when the opportunity arose. When there was a need for students to recall details or to help them remember something, they knew they had mindsketching in their “arsenal.” According to Tina, “It all happens very naturally.”

She also shared how her students became less reticent and more vocal in class. “They [the students] simply blossomed like beautiful flowers,” exclaimed Tina. For example, most of her students did not like to read. But after using mindsketching, students enjoyed reading more. Tina recalled one of her students who used to hate reading. She said:

> Now…reading didn’t become a punishment. It became something that he enjoyed. And when he can quickly sketch out what he wanted to remember, he realized, ‘Wow! My mind. I totally can follow this. I totally get this. I’m perfectly capable.’ It took away some of the pressure. I just feel like he feels like such a success story.

Tina has become so comfortable with mindsketching that she now has changed some of the procedures she used when she first learned mindsketching. One of the things she was taught at the training was for students to touch their sketches as they shared with their partner. Tina taught this for a year and then she decided to do away with the

touching of the sketch. She also did not encourage the students to lean over and look at other students' sketches. She explained:

> In the beginning, I think I let them do a little bit too much [touching the sketch], where they were looking and sharing to read... And that's probably a mistake…You don't even have to lean over. You don't have to look at my sketch. You don't get to judge it.

Tina found that students would spend more time looking at each other's sketches while making comments. So now, she has the students describe their sketches without actually showing them to their partners. Tina reasoned, "It [The sketch] doesn't talk to anyone but you. I don't have to know what it says. You have to be able to put words to it. So only [sic] it's to talk to your brain."

Tina believed that sketches created by the students were not just initial prompts to get the students engaged in oral discourse. Mindsketching was also an invaluable aid to help them in their memory. She shared how one of her biggest challenges was to get students to refer to their sketches long after they were produced to trigger their memory. She remarked:

> …memory is a biggie…you want that sketch to be quick, but… you need to know what that sketch said…A week from now, it does you no good. If you've got that stick figure and that stick figure stays the same for you, for every novel all year long, that's not going to speak to you in six weeks.

All in all, Tina is very happy with the progress of her students. She saw her students grow academically and doing better on the school exams. She excitedly shared

that the following year, she would be "inheriting" Deborah's students in the fifth grade. This would free Tina from doing introductory lessons on mindsketching and instead, build on what they already knew. Tina felt this would be the best time for her to further explore mindsketching and make it her own.

Tina shed a little tear as she summed up her feelings about mindsketching:

> I just watched children that were reticent, and did not speak in September, find their voice and feel empowered by the end of the year. And I can imagine in that years before they walked in and they walked out, still not speaking, still not finding their voice. And I just think mindsketching was that bridge to a voice.

Summary of Tina's interview. Tina was invited to attend training on mindsketching because it was specifically geared towards students from poverty with low verbal skills. Her fifth grade students were found to have low verbal scores and Tina was keen to learn new ways to help them.

She knew immediately during the training that mindsketching was a potentially powerful tool for her students who were not engaged in the classroom. They were unable to express themselves verbally and therefore, found it arduous to engage in oral activities. In Tina's opinion, mindsketching could open new doors for her to experiment different ways to engage her students and help them achieve academic success.

According to Tina, mindsketching was akin to having "a snapshot in your mind." She alluded to this "snapshot" again when she recognized that once her students did not have a "mind movie' when they read something, that signaled to her that students did not understand what they were reading, and that they were "unplugged" from the lesson.

Thus, mindsketching provided a way for her to check immediately if her students did not understanding something.

Tina used mindsketching in several ways, such as surfacing prior knowledge, engaging students in character study in novels, and sequencing events in a narrative. Tina also used mindsketching extensively as an assessment tool in social studies. The students were permitted to sketch their answers as aids to help them write complete sentences.

Tina insisted that after any sketching activity, students must describe their sketches to their partners. She did not encourage students to look at each other's sketches while the student partners were engaged in a conversation as the sketches were meaningful only to the producers of the sketches. As a result of practicing mindsketching and verbalizing their thoughts, her students were more vocal and could speak and write in complete sentences more easily. The success of mindsketching was exhibited in the students doing better on exams.

After four years of using mindsketching in the classroom, Tina is very comfortable with the tool. Before, during lesson planning, she had to think of appropriate places within the lesson to incorporate mindsketching. However, now, mindsketching came naturally to her and she used mindsketching when the need arose. These needs may be when the students faced obstacles in understanding a concept or when the students needed help to remember details of a portion of the content learned.

Winnie. Winnie is in her forties and has been teaching for 21 years. She specialized in reading and has a minor in literature. She taught all the way from first to

sixth grades, except fifth grade. She also shared that she had been voted "Teacher of the Year" three times. She had been using mindsketching for four years.

At the time of the interview, Winnie was teaching first graders. She shared that when she was first told to attend the training on mindsketching, she felt "frustrated." When asked why, she replied she was "very hard-headed" as she normally took a long while to transfer any kind of training she received to classroom practice. Moreover, she initially thought that the training was only for gifted and talented (GT) students and in her own admission, found it a struggle to teach GT children as she "didn't understand them." However, as she sat through the training session, she found that the training was not only for GT students but for every child, especially children from poverty.

For Winnie, mindsketching was as natural as taking notes when she was in college. She said, "It's like when you're in college and you take your notes a certain way." For her personally, mindsketching was "…a quick idea you draw. I think because it's your idea and you picture it, you retain it more because you're the only one who understands it." Winnie elaborated on what mindsketching meant to her:

> When you lend someone your college notes, and they're like, 'What in the world?' and you're like, 'This is how I understand it.' So I think it's everybody– it's the children's way of understanding. And the thing is, I think it's embedded in their heads and their memory. It [The image] stays.

Winnie explained how she explicitly taught mindsketching to her first graders. Each student had a small whiteboard, a non-permanent marker, and socks as erasers. She said:

> I'll have them draw a picture. Sometimes they'll draw a house and I want to see details and grass. And then after that, I'm like, because we use socks to erase and I'm like, 'Okay, erase the windows and erase the doors.' And that's how I'm showing them that sketching is just lines. That's how I introduce them to the sketching.

Winnie confessed that at first, many of her students liked to draw and add details, but she had to constantly require them to practice mindsketching instead. Her advice to the students was, "You can use a shape, a line, but once you're adding a face or eyes or hair, that's no longer a sketch." Last year, Winnie decided to take the first three months of the school year to get students to draw pictures with details and then slowly introduce them to sketches with minimal details. To her amazement, she found that students "got tired of drawing details." She explained her "little discovery,"

> They just would rather sketch because there's times I would give them an option after they, like around April, I would say, 'I want a list of five farm animals and it's up to you if you want to draw or sketch them but I do want the list.' So they number their list and they name the five animals and for the most part, they were sketching...But I think that's where I saw that they loved to sketch because by October, they're tired of all these details… So once we were sketching, they're like, 'Yippee, we don't have to do all that detail.'

The crucial part of mindsketching, according to Winnie, was students verbalizing their sketches. She felt the verbalizing portion was what the students enjoyed. She explained:

> Only you understand your sketch [and] that's why you have to turn around [to a partner] and explain it. So after they sketch, they turn around and explain. I try to get them to do a lot of talking because I want them to really learn from each other. That's how they learn.

Winnie showed some of her students' assignments for social studies The task for the students was to sketch the evolution of telephones using a timeline. Winnie explained that they sketched the images as she read the text to them. She shared:

> They had a sketch and then they put it together and here it is on a timeline. And they really enjoyed that because at first…we were talking about the different phones and how they had changed throughout the year. And then we sketched it and so some of them just drew a cone. And then here, some of them just drew like a stick with a circle. And then the cellphones were just squares.

Winnie explained that after students sketched on the timeline, they were given sentence prompts to help them say in words what kinds of changes they noticed. An example of a prompt was "Telephone A is different from telephone B because ____." Using prompts like these, students were able to talk about the changes of the telephones through the years with their partners.

Winnie also explained how her students had to constantly practice mindsketching right from the start of the school day. She called them her "morning messages." She provided an example of a "morning message,"

> And so sometimes, I'll do like, 'Sketch me pictures that begin with the letter B.' And so they're sketching all these sketches and I'm trying to just get that

> vocabulary out. Like today, the assignment was like, 'Sketch an addition sentence.' So they had to sketch that out.

Winnie's "morning messages" were also employed as review strategies. She provided an example of how in their science lesson, students were taught how plants grew. In the "morning message" she asked the question, "Sketch all you know about plants growing" and after students sketched what they knew, they shared orally with a partner and learned more by filling in each other's gaps of information. After the oral sharing, students followed up with a writing activity. Winnie reasoned that the writing activities were not so daunting to students because they simply wrote down what they verbalized earlier with the help of the sketches. She told her students that just like "illustrators for a story book uses pictures to go along with the words," the students were taught that their "sketches go along with what you write on paper."

When asked about particular success stories, without missing a beat, Winnie cited a student who was retained in the first grade. She worked with him, using drawings at first, to help him verbalize his ideas. Then, when he learned mindsketching, Winnie noticed "a huge change" in him. She shared her experience:

> His pictures never made sense. He would draw like a dot and a stick and I would say, 'All right, so what are you sketching?' 'Hmm,' and I was like, 'Okay.' At first, he did not have the language. I knew he saw it in his head. He saw it, but he couldn't express it in words. But eventually, he managed. He's reading wonderfully now.

Another success story came from Winnie's sister, who taught reading for eighth graders. Her sister would complain that her students did poorly in reading because they had to read "those long sentences." Winnie suggested mindsketching to her sister. She shared:

> So she tried it in her tutoring program and she said, "You know, those nine kids, they all had flunked the STAAR (State of Texas Assessments of Academic Readiness) test. So when they took the test the second time around, she said, 'they passed−eight out of nine.' You see, they all were actually sketching what they were reading and she said, 'I think that meant more to them because the stories stuck to their head.'

Winnie shared her understanding of the power of mindsketching. According to her, a sketch could simply be a line, but "it means something to them [the students]." She explained why mindsketching was not just a teaching tool; it was an effective learning tool as well. She elaborated:

> And that's where I think it's personal. It [The sketch] becomes theirs…that's why I like it. It's personal. This is mine. This is how I understand the story. This is how I'm showing my teacher that the story makes sense to me. And because it makes sense to me, I've got it up here [pointing to her head]. And that's why I like the sketching because I think that's the connection.

Winnie lamented that her students, who were mostly from poverty, did not have enough experiences to draw from when learning something new. For example, when she asked her students to sketch what they saw, heard, felt, or tasted during the fall season,

her students were “clueless.” She changed the task slightly by getting them to sketch things associated with the fall season, and again, they encountered difficulties as no images came to their minds. Winnie attributed to this lack of images in their minds to insufficient support from home. She shared her own experiences growing up in poverty. She stated that her parents “were wonderful but they didn't expose us too much.”

According to Winnie, a lack of exposure to a stimulating environment caused a child from poverty to have trouble observing details within an environment. Winnie shared:

> I asked them to sketch 10 to 15 things they saw on their way to school. Some of these kids don't; they're not observant at all. They just get to school, get off the car and come in here. And so it was hard for them to even sketch like three things they saw.

Winnie attributed to her students’ lack of attention to details to being unable to make connections in their own lives. She went on:

> We're building on making connections and so what I do is read a story and we talk about how they can make a connection, either something that happened to them, their mom, their grandma. And I read this story about a chicken and I told them, ‘My grandmother had chickens and when we would go visit her, the chickens were in the kitchen. I was always so afraid because I was always getting pecked by these chickens.’ So, when making connections with a story, I ask my students, ‘How can you picture something that happened to you from the story?’

> or ‘How can you bring an idea and say, you know what? This happened?’ Ok, now sketch them.

When Winnie tried to get her students to make connections like the above example, her students were able to sketch, make connections with the story, and remember more details about the story.

Because of a lack of a stimulating learning environment at home, Winnie felt that higher-order thinking skills, such as predicting outcomes, was a challenging skill for her students. She shared how she asked her students to sketch what they thought would happen next in a story. Her students were not be able to sketch because they “have no ideas in their little minds.” This was one area Winnie hoped to work on–using mindsketching to practice predicting outcomes using simple prompts like, “What do you think is going to happen next?”

When asked if she had any challenges implementing mindsketching, Winnie replied that one challenge she faced was how to truly make mindsketching her own and to explore new possibilities of this strategy after using it for four years. Another challenge, she added, was the demands of the administrator. She remarked:

> And sometimes, the things that they [administrators] want…Like for instance, let's say a certain journal and she wants the journal to look a certain way. And she wants the journal to have certain things and so you're thinking, ‘What a waste.’ This journal doesn't mean anything. It doesn't teach the kids anything when I can just omit the journal and focus more on other strategies. So that's where, I think, is hard for us.

When the interview ended, Winnie continued to show her students' sketches in their notebooks. There were shapes, scribbles, and squiggles, but Winnie shared that the students actually referred to their sketches in their oral language and writing tasks.

Summary of Winnie's interview. Winnie shared that she was not keen to attend the training on mindsketching as she thought that the training focused on gifted and talented students and so, did not apply to her. However, she was drawn to the idea of mindsketching because she used to take notes pictorially while in college. Therefore, to Winnie, mindsketching was a tool to capture ideas from one's mind onto paper.

Winnie decided to slowly introduce mindsketching after students experienced drawing with details for three months. This was a departure from the training sessions, where the teachers were taught to introduce mindsketching without engaging the students in any kind of long term instruction on detailed drawing. In Winnie's situation, students gravitated towards mindsketching because they were tired of drawing details in their diagrams. Mindsketching was seen as a better alternative by students because it was less time-consuming.

Winnie's emphasis on verbal interaction between students was evident when sentence prompts were used to help students express themselves using full sentences. More importantly, sentence prompts helped students focus their discussions on the topic at hand. When talking with a partner, the sentence prompts helped students to fill each other's gaps of knowledge so there was collaborative learning. As a result of the rich oral sharing, Winnie reasoned that writing was not such an uphill task for students as they simply needed to talk about each sketch and then write what they said.

Although Winnie had much success with mindsketching, she lamented on the demands imposed on teachers by the administration. Despite the pressure, she still continued to explore how mindsketching could open up new possibilities to help her students do well in the classroom. She knew that her students from poverty did not possess rich experiences, so she constantly tried to expose her students to what was going on around them to help them make connections with what they were studying.

Classroom Observations

Beverly. Beverly was working on vocabulary in her fourth grade class. The first word in this lesson was *interlac*e. On the white board, she drew a diagram and told her students to do the same in their notebooks. The diagram is shown in Figure 1.

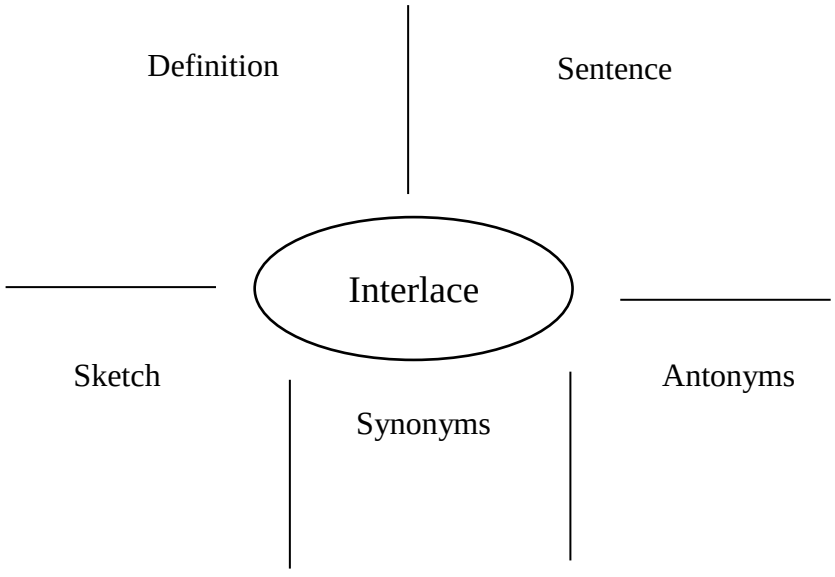


Figure 1. Beverly's illustration for vocabulary practice

Beverly proceeded to use her fingers to make some interlocking motions. She posed this teaser to her students while doing the motions: "You know, this vocabulary word reminds me of something." One student mentioned *weaving* and another student said *mats.* Beverly then asked them, "So, what I am I doing?" She received responses like *weaving*, *criss-crossing*, and *knitting* from a couple of students. After they had given their responses, Beverly turned to the class and said, "Were they missing something?" The rest of the students chorused, "Interlace means…!" The two students laughed and gave their responses in full sentences: "Interlace means criss-crossing" and "Interlace means knitting."

Beverly continued to probe for more responses from her students. She asked them what action was being done when someone was weaving or knitting. She got the students to close their eyes and imagine the movements. A few students responded that the needle was crossing over another needle. Beverly responded, "Yes, interlace is to cross over. Very good." The students were then asked to close their eyes again and then open their eyes to sketch what they "saw in their minds" when they thought of the word *interlace.*

As Beverly circulated the room to see what the students were sketching, she periodically asked the question, " Do we need details?" After the lesson, Beverly explained that normally, she would give the students only a few seconds to sketch, but for vocabulary lessons, they had "…a few extra seconds longer." She also pointed out that although the sketches were only meaningful to the students who sketched them and

not to the teacher, she still checked to make sure they were not adding too many details. In fact, during the lesson, she reminded the class, "Yes, we don't need hair and extra details, right? Sketches are quick and not meant to be pretty."

After sketching, students shared their sketches at their tables–four students in a group. After sharing, students wrote the meaning or definition of the word *interlace* in a complete sentence in the corresponding space in Figure 1. They also wrote down their own sentence with that vocabulary word.

After the writing exercise, the students referred to a thesaurus to search for synonyms of *interlace.* The students could not find any. At this point, one student said, "Can I sketch something on *weaving* so I can remember?" Beverly allowed the students to sketch any one of the responses that were provided earlier in the lesson such as *weave* and *knitting.* She emphasized to the class again to sketch without details but enough details for them to remember what the sketch was about. As for the antonyms, Beverly told the students not to look them up in the thesaurus but to share what they thought. Some students responded *up and down* and another student said, *parallel lines.* With every response, students were told to write those words down in the respective space in their diagrams.

Beverly proceeded to the next vocabulary word, *vast.* She read the following sentence: "The coastal plain is a vast area of land that is flat." She told the students to close their eyes "to capture that image" and then sketch what they thought '*vast* meant. Beverly again reminded the students: "Remember, a sketch is not a drawing. Just something to remind you of the word." After students sketched, Beverly got them to

share in their groups and then requested them to provide some answers. Students mentioned *big* and *large.* Just like the previous word, students wrote the meaning in a full sentence.

This time, when the students searched for the synonyms and antonyms for the word *vast* in the thesaurus, they did not encounter any problem locating the words. At this juncture, Beverly instructed her students to choose the "juiciest' word so that people would want to read more. The students seemed to get very excited to see words like *immeasurable, extensive,* and *monstrous*. Beverly circulated the classroom, helping students to pronounce the words from the thesaurus.

The next vocabulary word was *abandon.* Beverly told the students, "Whenever we have a fire drill, we have to abandon everything. What do you think *abandon* means?" The students responded with, "put things away" and "not to take anything." Beverly posed this question: "Do we take anything with us during the fire drill?" The students chorused, "No!" Some students responded, "We leave everything behind." Beverly then told the students to sketch the meaning of *abandon.* Just like the previous two vocabulary words, students went through Figure 1 and filled it out accordingly.

After the vocabulary lesson, the students continued with poetry. The title of the poem was *I'm in a Rotten Mood Today*. The poem was projected onto the screen and as Beverly went through the poem, she highlighted certain words she felt her students may find problematic. Some examples of those words were *stew* and *snit.* As she read the sentences, she asked the students, "What do you see?" She gave them time to sketch what they thought those words meant and probed for their explanations of the sketches.

Then, she explained the meanings of those words so they could modify their sketches if necessary. She also instructed them to sketch the main idea from each stanza.

When the lesson ended, Beverly explained the homework assignments for that day. She called on a few students to repeat what the assignments were and to say them in full sentences. Beverly later shared that students were expected to use their sketches to explain to their parents the vocabulary words they had learned for that day.

Summary of Beverly's classroom observation. Throughout the vocabulary lesson, Beverly used actions or contextual clues to help her fourth grade students arrive at a suitable meaning for each vocabulary word they were learning. She asked questions about each action she was doing, or she provided a sentence to help them work out for themselves possible meanings of the target vocabulary word. Throughout this entire process, students were expected to answer Beverly in complete sentences.

The students proceeded to sketch the meaning of each word in a handout provided. As they sketched, Beverly made sure that they were sketching and not adding unnecessary details. She continually reminded them that sketches had to be quick and were "not meant to be pretty."

For the lesson on poetry, when students came across unfamiliar words, Beverly asked them what they saw in their minds. She read the sentence several times and asked leading questions to help them picture the words in their minds. Students then sketched each unfamiliar word. While Beverly continued to ask probing questions, she allowed her students to change their sketches if necessary, to reflect more closely the meaning of the target word. They also sketched their main ideas for each stanza of the poem.

To reinforce the importance of speaking in full sentences, Beverly called upon a few students to explain the day's assignments. As part of the practice of using sketches as a springboard for oral language, students were expected to use the sketches they had produced for the day to explain the meanings of the vocabulary to their parents.

Cheryl. Cheryl had just read a story to her second graders. When the next lesson was about to start, one of her students came up to her and communicated how he felt sorry for the main character. He shared with her for a couple of minutes and after his sharing, Cheryl said, "Kiss your brain!" Cheryl later explained that this particular student did not do very well in first grade. He was always quiet and kept to himself. However, when he learned mindsketching, Cheryl noted him "blooming like a flower" and now, he "talks non-stop."

Cheryl's lesson was about components in a story–character, setting, plot, and sequence of events. The students had already read the story of *Olivia the Pig* the previous day, and Cheryl wanted to check if the students could remember what they had read. She started off by asking students to close their eyes and think about the story. She said, "Think about the pictures in your brain. Can you see the pictures in your brain? You should have at least four pictures, beginning, middle, and end of the story."

Cheryl then instructed students to sketch five things that happened to Olivia. Before sketching, she reminded them not to think of the details. In a commanding voice, Cheryl called out, "Number one!" The students immediately started to sketch in their notebooks. After counting aloud five seconds, Cheryl clapped her hands once and called out, "Okay, stop! Do you need details? Do you sketch quickly?" The students gave a

resounding “No!” to her first question and “Yes!” to her second question. Then Cheryl said, “Okay, are you ready? Let’s go for number two! Go!” The students immediately sketched the second diagram. After five seconds, Cheryl declared, “Stop! Remember all pencils down. Ready for the third? Go!” She continued this procedure until the students completed five sketches.

Once students had their five sketches, Cheryl posed this question: “Look at your sketches. Are they in order?” Most of the students replied their sketches were not in order. One student piped out, “Ma’am, I was just sketching what I saw in my mind.” Cheryl told him it’s alright as it was more important that they see pictures in their minds. She then instructed her students to put their sketches in the order of the story they had read the day before. Cheryl later shared that the students had difficulty remembering what they read previously and this was her way to check their memory.

Once students sorted their sketches, she instructed them to share with a designated partner. They had to share what they sketched and narrate the story using the sketches. Cheryl reminded students to talk about one sketch at a time and to speak in complete sentences. She gave them a sentence prompt–“I sketched this picture because…”

After the sharing, Cheryl allowed students to refer to their readers while she played an audio file of the story with accompanying pictures projected on the screen. As the story progressed, Cheryl reminded students to look at their sketches and check if they were in the correct order.

After reading the story, Cheryl gave students a few more minutes to check their sketches and re-order them if necessary. She also told them, "If you feel you have left out an important detail in the story, you can now sketch it." Cheryl later clarified that she would now always ask that question because "…after sharing with their partners, they [the students] would want to add more sketches to help them remember what they left out initially. Sometimes, during the sharing, they suddenly would recall a detail so they would sketch more."

Toward the end of the lesson, students engaged in a summary-writing activity. They were expected to write the story in their own words using the sketches to help them. Cheryl reminded the students, "Remember, write one sentence about each sketch." While the students wrote their stories, Cheryl had a smile on her face and shared:

> I used to hate the writing bit as the students had no clue how to write or what to write. But now, see? The students simply write what they just shared with their partners. You write the sentence of what you just shared.

Throughout the lesson, when the students exhibited greater understanding of the lesson or if they answered questions correctly, Cheryl would say, "Now, kiss your brain!" Cheryl later explained that this was her way of affirming them. She stated, "The more pictures they see in their minds, the more they understand."

In another classroom observation, Cheryl had a similar lesson about recalling a story the students had just read. Her second grade class was a different one as it was five weeks into the new academic year. The students had already learned mindsketching

during the first couple of weeks in school. Again, they had to sketch five important details in the story, *David's New Friends.*

In this particular classroom observation, since the students were relatively new to mindsketching, Cheryl had a slightly different approach to getting students to sketch. Instead of creating five sketches one after another, Cheryl instructed the students to do one sketch, and then talk in turns about the first sketch with a partner. After that, students made a second sketch and then they shared with their partners. At one point, when Cheryl instructed students to make the third sketch, a few students started talking. Cheryl immediately stepped in and said, "No, don't talk, let your brain talk to you."

Throughout the whole mindsketching session, Cheryl reminded students to pick out an important detail from the story. She said, "Close your eyes. Can you see it [a picture]?" She also commented, "If you're running out of time, then you're drawing, not sketching. Remember you're sketching. Throw out the details." To help her students sketch the important details from the story, Cheryl also asked questions, such as, "Is David combing his hair an important detail?" "Is David carrying a backpack an important detail?" and " Is David wearing shoes an important detail?" After the sketching and sharing, students were told that the sketches would be used for the following week for summary-writing. Cheryl later shared that in her experience of using mindsketching, she found that students actually referred to the sketches to help them jog their memory for important details to write a summary of a story.

Summary of Cheryl's classroom observations. In Cheryl's second grade class, she used mindsketching in several ways: to help students recall what they had learned, sequence information, and engage in oral language.

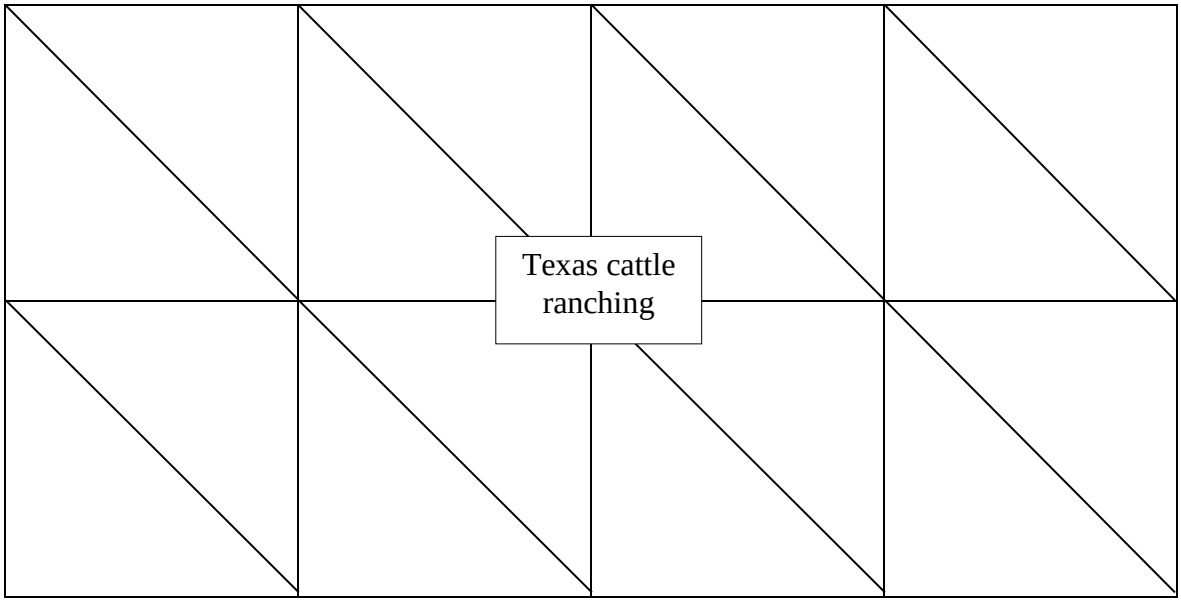
To check her students' memory, Cheryl instructed her students to sketch important details from a story they had read the previous day. She told them she wanted five sketches. After they completed their five sketches, students were told to review their sketches to check if they were in the right sequence. Once students were satisfied with the order of their sketches, they proceeded to share the story orally with their partners. Another variation Cheryl had was for students to share orally after each sketch. Throughout the oral portion, they were reminded to speak in complete sentences with the help of sentence prompts.

As further reinforcement to help students recall information and sequence their respective stories, an audio of the story was played with accompanying pictures projected onto the screen. Students were encouraged to check if they needed to add more sketches or to re-order the sequence of their sketches. The mindsketching activity culminated in a summary-writing task using the sketches.

Cheryl used phrases and questions such as "Let your brain talk to you" and "What do you see in your mind?" to encourage students in their mindsketching. When students did something well, such as speaking in complete sentences or providing unusual answers, Cheryl used her own phrase, "Kiss your brain" to further emphasize the idea that their minds were helping them learn.

Deborah. Deborah's fourth grade students were just filing in to their desks. On the projector, there were pictures on cattle ranching. This lesson on social studies was a continuation from the previous day. Deborah instructed the students to look at the pictures and share with a partner on what they saw. They were to use this sentence prompt: "When I saw this picture of a [blank], it reminded me of [blank]." The students could use a word or phrase that they learned the previous day or it could be something new they had come across. Deborah later explained that she wanted her students to speak in complete sentences right from the start of the day.

After the sharing and some group responses, Deborah handed out a sheet of paper with the title *Texas cattle ranching* in the middle of the paper. A diagram is provided in Figure 2.



[*]*Figure 2.* Deborah's template to review previously learned content (Juntune, 2013)

Before sketching, Deborah asked the students the meaning of a sketch. Most of the students gave responses like, "It's when you use the least lines" and "It has little details." Deborah then answered, "Yes, it is something only you understand and others cannot." She then lowered her voice and whispered, but loud enough for students to hear, "Remember, it's in your mind and it has to be quick." She shared later: "Before any sketching activity, I always ask them what it [sketching] is as a sort of reminder."

Using the upper portion of each box in Figure 2, students were instructed to sketch anything they knew or remembered about Texas cattle ranching. Students were given three minutes to complete the upper portions of each box. When the time limit was over, students were instructed to put their pencils down and share with their partners.

*Template used and adapted with permission from workshop titled "Closing the achievement gap for students from poverty" by Joyce Elaine Juntune, 2013, El Paso School District, El Paso, Texas.

They were required to use the prompt, "I sketched this sketch because [blank]." They were given three minutes to share. Deborah added, "Remember, from your brain, to your sketch, to your mouth." Deborah later revealed that that was her "favorite mantra." The students were reminded to point to their sketches to help them focus as they shared in complete sentences.

After the students completed their sharing, Deborah took out a container with ice cream sticks. Each ice cream stick had a student's name written on it. Deborah randomly selected eight sticks and called out each name. As each name was read, Deborah instructed the students to write the first letter of each name on each of the lower sections of the boxes in their sketching sheet. The letters were *E, D, Z, T, P, W, K,* and *V*.

Deborah provided an example for the students: "If the letter is *G*, I can sketch *goat* because it reminds me that a goat is part of the cattle family, and in Texas, goats are part of Texas cattle ranching." Deborah provided the prompt for the students, "[Letter] is for [blank] because [blank]." She further reiterated that the sketch must be a relevant idea to cattle ranching in Texas. Again, students were given three minutes to sketch as Deborah circulated around the classroom. She shared later that when she first started using mindsketching, she would give five seconds for her students to sketch, but now she dispensed with the timer because she noted that her students could now sketch rather quickly.

After sketching, students shared in pairs first. Later, Deborah asked for responses from the students. One student responded, "*T* is for *tag* because the ranchers put it under the skin of the animal to identify it." Another student provided this example: "*P* is for

poaching because some cattle are stolen in the ranch." As students shared, they all responded in complete sentences.

After this lesson, students had a reading activity. Deborah distributed small racks of fictional books to each group of students, and each student picked out a book they had been reading. Deborah instructed them to focus on characters for this period of silent reading. Each student had some sticky notes and a pencil ready with them. They were required to sketch important details of the main characters as they read their books. Deborah reminded them that they were going to share with a partner, so the sketches must be "meaningful enough to remember."

During another classroom observation at the start of the semester, Deborah was working with a few fourth grade students. The rest of the students were engaged in a test at the computer center. The lesson was on poetry, and Deborah wanted to infuse fairy tales into poetry-writing. She instructed the students to take five sticky notes and place them on one side of a blank page of their notebooks. She asked them to choose one of their favorite fairy tales and sketch the important details in each of the five sticky notes. The sticky notes had to be in the right order. Deborah told them to sketch the beginning of the story on the first sticky note, while the ending was on the fifth sticky note. As for the three middle sticky notes, students sketched the main plot details.

After students placed the five sticky notes on one side of the page, they were asked to take three more sticky notes and place them on the other side of the page. Deborah instructed them to sketch the same fairy tale using three sticky notes instead of five. They could combine the sketches, or create new sketches to distill the essence of

the story. As students worked on their sketches, Deborah checked on them. One student was drawing many details, so Deborah asked him, "You see that hair? Now, that's adding a detail. Do you think you need another detail?" The student responded, "No, I think I can do without the hair." Deborah then said, "Okay, so now find a stopping point."

Once students had completed their sketches, they shared them with a partner. After the sharing, Deborah instructed them to write two or three sentences or "as many as you can" for each sticky note. As students were writing their sentences, Deborah explained that she found reducing from five to three sketches encouraged her students to write more. While students wrote their sentences, she reminded them to 'talk" to their sketches so as they verbalized, they could write more effortlessly.

When the students finished, Deborah told them to put their sketches away. She distributed printed handouts. She read a few quatrains based on a picture in the handout and asked students for the rhyming scheme. Once Deborah was satisfied that the students knew the various rhyming schemes, she moved on to a story that comprised three sentences. She explained to the students that she was going to choose a word from that story, and using that word, they were to provide rhyming words using the letters of the alphabet as a guide for the first letter. For example, she chose the word, *space,* and the students came up with words like ***a****ce*, ***b****ase*, ***c****ase,* and ***d****aze.*

Using the rhyming words from the base word, *ace,* Deborah directed the students to use the rhyming words to go with the three sketches they produced earlier. They were to create a quatrain using any one of the rhyming schemes they had studied. Deborah

later shared that she had used this lesson procedure before and it was successful. When asked what she meant by "successful" she replied,

> The sketches were really a tool for them to speak. As they talk to their sketches, they verbalize and they hear the sounds. I believe it helps them understand rhyming patterns, and they are also not afraid to write. Really nice pieces of work [written work].

As homework, the students were expected to produce three more quatrains based on another three rhyming patterns they had studied.

Summary of Deborah's classroom observations. In one of the classroom observations on social studies, Deborah projected pictures of Texas cattle ranching onto the screen as a sponge activity for her students to speak in complete sentences with each other. The students had a sentence prompt to help them.

After the students' sharing, Deborah engaged them in mindsketching to surface prior knowledge on Texas cattle ranching, a topic they had been studying for the past few days. Deborah provided students with a handout to sketch as many things as they could remember about Texas cattle ranching. After they had done so, students were instructed to share with their partners using another sentence prompt. To help them in the process, Deborah used the phrase "…from your brain, to your sketch, to your mouth" to signify the importance of using the sketches to help them articulate their thoughts.

On the same handout, students also had the opportunity to sketch any other information about Texas cattle ranching; this time, using letters of the alphabet that Deborah had randomly drawn. The letters served to stretch the students as they tried to

sketch information beginning with those letters. After the mindsketching activity, students again shared with their partners using complete sentences.

In a different lesson on poetry, Deborah used mindsketching to link what was familiar to the students to something that they were learning. In this case, students were asked to sketch their favorite fairy tales on five sticky notes and order them. Once they had done so, they were required to use the same fairy tale, but this time, to use three sticky notes. They were allowed to combine the sketches or make new ones. The purpose of distilling the fairy tale into three sketches was for students to write more than a couple of sentences for each sketch.

Deborah then switched to a handout on poetry and went over the types of rhyming patterns with the students. She chose three different words for students to find associated rhyming words for each one. Students were then required to use the rhyming word they had come up in connection with their sketches of the fairy tales earlier, incorporating any of the rhyming patterns they had learned previously.

Throughout the lessons, Deborah encouraged her students to "talk" to their sketches as they wrote the sentences. This was her way of telling students that writing was not difficult as long as the students had a "picture" in their minds. Further, when students "talk" to their sketches, they merely had to write what they had just verbalized.

Helen. Helen was teaching about the seasons in her science lesson to her second graders. This particular lesson dealt with the topic on spring. As the students sat in groups of fours, Helen instructed the students who were "number ones" to collect some pads of sticky notes while the "number twos" collected some white paper. The students

distributed those items to each student in their groups. Helen informed the students to take five to six sticky notes and get a pencil ready.

Helen prefaced each instruction by saying, “step one”, “step two”, and “step three." She later explained that when she broke down the instructions into one complete sentence, students were able to follow the instructions more easily. When she stated, “Step one, I want you to write your name on the top of your paper,” several students repeated her instructions softly to themselves.

For step two, the students were told to close their eyes and think of things connected with spring. As they closed their eyes, Helen said, “Look at your mind. Look at all the pictures you see in your mind.” Helen then continued, “Alright, now step three. Open your eyes and sketch what you saw in your mind. You have one minute.” She proceeded to set the timer for one minute. As the students sketched, Helen reminded them that there were to be no details in sketches.

After one minute, Helen instructed the students, “Okay, now you have your sketches. Step one, put your sticky notes on the sheet of blank paper.” Once the students completed the task, she continued, “Now, step two, I want you to share with your partners…in complete sentences. Use the prompt, ‘I sketched this because, and then you describe and explain your sketch. Okay? Ready and go.’”

After two minutes, Helen told the students, “Okay, now we go to step three. I want the person who was listening to repeat what your partner just said.” As students shared with their partners, Helen listened in on what students were saying. In one group, one student was overheard saying, “Ma’am, he’s not speaking in complete sentences.”

Helen then reminded students to speak in complete sentences. After three minutes, Helen instructed them to switch roles, so now the listeners were the ones to share their sketches and their partners had to repeat the information.

The lesson ended with a writing activity. Using the overhead projector, Helen wrote the following title on a transparency: Describe and illustrate the way your environment looks in spring. Helen explained, "…you now may have more ideas about spring after sharing with your partner…" Therefore, the students had the option of placing their original sketches on sticky notes or adding more new sketches based on the sharing they experienced. Students were to write "a sentence or two" about each sketch. Helen set the writing task for five minutes.

After the lesson was over , Helen explained that sequencing the instructions not only helped her students to be on task, but also, she believed that "…it provides an image for them on what to do for each numbered step." As a parting shot, she quipped, "It's amazing how easy it is for the students when you simply place a number before an instruction. What a difference it makes."

The second classroom observation occurred after five weeks into the new academic semester. Helen went through a story called *Hey Little Ant* with her first graders. As Helen went through the book, she asked the questions, "So, what is big and what is small? Which is bigger? The ant or the chips?" Helen later explained that the students had already learned the meanings of *big* and *small* in their science lesson and the big book reading was a reinforcement of those concepts. Further, the emphasis of the lesson was on students to speak in full sentences.

As Helen turned to the second to last page of the book, there was an illustration of the ant, which was now very much bigger than the other character, a little boy[4]. Helen asked the students to sketch their ideas of how they thought the story would end. She reminded the students, "Use the prompt–'If I were the ant, I would [blank].'"

After sketching, the students turned to their partners and took turns sharing their ideas for three minutes. Helen reminded them to speak in complete sentences. After the sharing, Helen asked for oral responses from the students. At the end of every response, Helen connected their ideas to the concept of *big* and *small.*

After the lesson, the students got ready to leave the class for their physical education lesson. As we were preparing to leave, I noticed some numbers with sketches on the bulletin board. I asked Helen about it and she explained that at the start of the day, the students used the numbers of that date to do a sketching activity. For that particular day, the date was the 23rd. The students had sketched "…how many ways you can have 23." Helen went on to explain that many students made different arrangements of 23 circles or dots, but she was surprised to see quite a few students sketch some ideas with subtraction as part of the concept. Since it was only five weeks into the semester, Helen expressed her optimism that the students, with further practice, would be able to incorporate more concepts like multiplication and division into their sketches.

Summary of Helen's classroom observations. Helen's second grade class dealt with the topic of *seasons* for their science subject. In this particular lesson, the students were going to learn about *spring.* Before teaching the topic, Helen asked the students to

[4] Throughout the story, the ant was smaller than the boy.

make several sketches on what they knew about the spring season. She used a timer to help them complete as many sketches as they could in one minute.

After they completed their sketches, they turned to their respective partners to share what they sketched. They use a sentence prompt to help them describe their sketches before using complete sentences. After the sharing, the partner who was listening to the description had to repeat what they had listened to check if they could remember the information. When the sharing was completed, the roles were reversed.

The lesson ended with a writing activity, where students wrote complete sentences about what they knew about spring based on the sketches. The students also had the option of adding new sketches if they remembered more information, or if they had other ideas that were triggered by the oral sharing earlier.

In another classroom observation, this time, with first graders, students were engaged in a big book reading session. The book was chosen because the students could make connections to an earlier science lesson. As Helen asked questions about those concepts, students were expected to answer in complete sentences. As the reading progressed, students made sketches of how the story would end.

Throughout the two classroom observations, Helen numbered her instructions to her students so they could remember the sequence of the instructions more easily.

Rosalind. Rosalind went through a mindsketching activity for a vocabulary lesson in her fifth grade class. She projected a page from *Animalia* onto the screen. She divided her students into two teams and their task was to look at the screen and sketch as many of those pictures and words as they could. In this particular case, every single item

on the screen began with the letter *P.* Some examples of words included *proud, preening,* and *plumage* while some examples of pictures included *penguin, princess,* and *palace.* Rosalind later explained that she used pictures from *Animalia* to help her students sketch "the bare bones." According to Rosalind, the words were used as "triggers to incite any images the students have on their minds."

Rosalind gave the students four minutes to complete the task. After four minutes, Rosalind instructed them to put their pencils down and count the number of sketches they made. The group with the larger number of sketches shared theirs while the other group put a check mark if they had those same items.

After this activity, Rosalind asked the students, 'Is there anything in the picture you did not have a name for?" One student showed Rosalind a picture of a pair of cymbals. She asked, "If those are cymbals, how can it start with the letter *P*?" Rosalind proceeded to ask probing questions and gave them some clues to help them. The students eventually arrived at the correct answer: *percussion.* Rosalind then explained some pictures and words that were deemed difficult for students. As she mentioned each name of the item, she told the students to sketch what came to their minds. She gave them time to describe their sketches to their partners, and if any student was not sure, the student raised his or her hand and explained the sketch to Rosalind to seek clarification.

Students were then given one minute to sketch any additional ideas. Rosalind encouraged her students to share those ideas using "long juicy sentences." She provided more instructions to help them describe their sketches. She said, "Say what you sketched. Define it in a complete sentence. Describe your sketch in your most juicy

vocabulary." Rosalind later remarked that when she mentioned "juicy" in class, the students understood that she meant exciting and fancy new words they had not used before

After this activity, Rosalind instructed students to take out their paragraphs they had worked on the previous day. It was an essay on what they did during the summer. She instructed them to insert three new words they had learned into the essay. A few students asked if they could add more than three new words. Rosalind reminded them the new words had to make sense within the context of what they were writing.

For the second classroom observation, Rosalind started her fifth grade social studies lesson with a warm-up mindsketching activity. She distributed *A4*-sized paper to the students. Rosalind said, "Let's use our expanded minds. Think of as many ways as you can on how to use a raisin. Remember, these are sketches, not drawings. Set? Now sketch!"

She gave them one minute to sketch. Once the minute was over, Rosalind instructed them to put their pencils down. She elicited responses on what mindsketching was. Some responses from the students were "messy drawings" and "undetailed drawings." Rosalind asked, "Who is the drawing for?" Some students said, "They are for someone else." Rosalind followed up by asking another question, "So, who is the sketch for?" The response from the students: "The sketch is for me only." One student added, "The sketch is to talk to your brain."

Rosalind later explained that before any mindsketching activity, she asked those questions to remind students what mindsketching was. Although the students were

taught mindsketching in fourth grade by another teacher, Rosalind said, “I still want them to tell me what it [mindsketching] is. Also, they must speak in complete sentences when they talk to me.”

Rosalind continued with another warm-up activity. This time, they had to sketch “…things that were red.” They were given one minute to sketch and after the time limit, students shared their three most unique ideas with a partner. Rosalind reminded the students to speak in complete sentences. She told them, “Your sentences must be eight words or more.” She also gave them a sentence prompt, “What I thought was unique was [blank] because [blank].” After three minutes of sharing, Rosalind asked for examples of unique ideas from the students. If the student responded in one word or a phrase, Rosalind used her fingers to show a stretching motion, indicating to the student to speak in a complete sentence.

For the third warm-up activity, Rosalind reminded the students to “…try to dig into your brain and stretch it.” This time, students were asked to sketch many uses for a rubber band. Again, the duration was one minute, and just like the previous warm-up activity, the students also shared their sketches.

After the three warm-up activities, the students were divided into their groups according to the regions of the United States. They had been working on their assigned regions as a group. Before the lesson started, Rosalind shared that she needed to go through the lesson again because a substitute teacher taught the topic. As Rosalind graded some assignments, she realized there was misinformation and misconceptions on the part of the students.

As part of a review of what the students learned, Rosalind handed out an *A3*-sized paper to pairs of students working on the same region. Their task was to take turns to sketch anything they remembered about their assigned region. Rosalind reminded students to talk as they sketched and to speak in complete sentences. She also said, "Remember, the sketch is talking to your brain, not mine."

The students were given fifteen minutes to sketch their ideas on the paper. While the students were on task, Rosalind drew the following table (Figure 3) on the chalkboard.

	North-East	South-West	Plains (Middle West)	North-West	Far North
Location					
Habitat (Environment/Biome)					
Resources					
Homes					
Food					

Figure 3. Rosalind's template to describe the various regions of the United States

After fifteen minutes, Rosalind called upon different pairs of students to provide information on their respective regions using the grid. She reminded them to respond in

complete sentences. As students responded, Rosalind filled up the grid with the information, pausing at certain times to ask clarifying questions.

For the section on *resources* on the grid, Rosalind garnered responses from each group, tying back to a book they had been reading about Paul Bunyan in the *American Tall Tales*. After a class discussion on the importance of resources in the United States, Rosalind handed each student the book, together with a large sticky note. The students were tasked to refer to their respective regions and make sketches on the sticky note as they read three pages of the book, looking for ideas that related to the grid, such as, *habitat*, *resources*, and *food*.

After the students read three pages, Rosalind instructed them to sketch what happened so far in the story. She further explained: "You can add enough details to help you remember the sketches a week from now, but not so many details that you need a long time to create that image." Once students completed their sketches, they shared with a partner three things that happened in the story. Rosalind again reminded them to speak in complete sentences.

The lesson ended when it was time for students to attend their orchestra practice. Rosalind shared that she would continue with the book when the students returned.

Summary of Rosalind's classroom observations. For the first classroom observation, Rosalind utilized pictures and words as triggers for the students to sketch. All the pictures and words began with the letter *P* and students were encouraged to capture the essence of the pictures and words in their sketches without adding details.

While the students shared their sketches by group, the other groups checked off their sketches if they were already mentioned.

As for the pictures that students were unable to identify, Rosalind gave the name of each picture and asked them to sketch what came to their minds. They were to describe their sketch to their partners in a complete sentence with the help of sentence prompts. Rosalind also encouraged them to use impressive vocabulary to describe their sketches.

After the sketching activity, students continued to work on their essays about what they did during the summer. They were instructed to use at least three new vocabulary words they learned during the sketching activity. The students were reminded to use the words within the context of their essays.

In the second classroom observation, Rosalind engaged students in three warm-up activities, where they had to sketch uses of a raisin, things that were red, and uses of a rubber band. Throughout the warm-up activities, Rosalind elicited responses from students on what mindsketching entailed, while reiterating the importance of speaking in full sentences when the they described their sketches to peers.

After the warm-up activities, students were engaged in a lesson review of the various regions in the United States. During the lesson review, they sketched what they remembered for their respective regions in the United States. The activity enabled Rosalind to gauge her students' understanding of the various regions.

The students were tasked to make connections with the grid and the book they were reading about Paul Bunyan by sketching their ideas. They also sketched the main details of the story and shared those details with a partner.

Tina. Tina was teaching social studies and history to her fifth grade class. In the first classroom observation, Tina focused on plot movers from the book, *Number the Stars* by Lois Lowry. This book is a historical fiction set in World War Two about the escape of a Jewish family in Copenhagen. She told the students to take 10 to 12 sticky notes for their mindsketching activity.

Before the activity, Tina asked students the meaning of a sketch. One student replied, "It's like a picture with little details." To this, Tina replied, "Yes, sketches do not talk to others. Who does it talk to? At this point, the students chorused, "Me!"

After reminding the students about sketches not having many details, Tina proceeded to ask students to sketch 10 to 12 "big ideas" of what they had read thus far. The students were given five minutes to sketch. While the students were sketching, Tina circulated around the classroom to check on the students. As she circulated, she reminded students not to add "super minor details." Instead, they were to sketch "what talks to your brain." After five minutes, they talked about their sketches as a group.

The next part of the lesson was what Tina termed as the "memory moment." That was when she read a portion of the book while the students listened. After reading for two minutes, she permitted the students to sketch the main details of what kept the plot of the story going. Throughout the mindsketching exercise, Tina encouraged students to

"chop, chop, chop extra details." She also told them not to waste time putting the sticky notes in order, but to simply sketch one idea on each sticky note.

After about five minutes, students took turns sharing their sketches of the main plot movers with another student. Tina circulated around the classroom, asking questions and checking the students' progress. She also allowed students to add on to their sketches if their partner shared something that they did not think of earlier and felt it was pertinent information to the plot. This was done by taking the idea from the partner and sketching the idea on their own. Tina later explained that students were prohibited from copying each other's sketches. Instead, they were allowed to take the ideas but still sketch them as they gained new understanding. After sharing, students were told to order the sketches sequentially according to the story.

Tina then turned the students' attention to another book; this time, a picture book titled *I Will Come Back for You* by Marisabina Russo. The story was also set in World War II. It was based on a true story about growing up Jewish in Italy. The students sat on a mat while Tina sat on a high chair with the book in her hands. She held up the front cover of the book and asked students to make predictions about the title, based on what they read from the first book. One student replied, "I feel like the book is about the Nazis about to invade."

Tina instructed the students to take five or six sticky notes. They were not to do any sketching while Tina read the story. As she read the book, she stopped reading at a certain point and told the students to sketch how the story started. Students were given 10 seconds to sketch. As she continued reading another page, she asked them to sketch

"details from the story you want to remember." Again, they were given 10 seconds to sketch. Periodically, Tina reminded them that the "sketches only talk to you." Tina continued to read a couple of pages, stopped, and then asked students to sketch the main ideas.

After about eight pages, Tina instructed students to take out the first set of sketches based on the first book as well as the more recent sketches based on the second book and lay them out on their tables. Working individually, the students had to look for five or six connections between the two stories based on the sketches. They also shared their connections with a partner. As students shared, Tina reminded them to speak in complete sentences. The lesson ended when the students were dismissed to attend an art class.

The second classroom observation in social studies occurred during the new academic year. There were two students who were still learning mindsketching, unlike the rest of the class, who already did mindsketching the previous year in Deborah's class. For this lesson, Tina told her fifth graders to take 8 to 10 sticky notes. As the students were taking the sticky notes, Tina went over to the two new students and reminded them not to draw. She said, "Don't give details, let your brain talk to you."

The students' task was to sketch any object that needed to be plugged in or charged to a power source for it to work. Before the mindsketching activity, Tina elicited some responses. Students provided responses such as mobile phones, computer, and television set. Tina then instructed students not to sketch those items in their sticky notes. As students sketched, Tina encouraged them to close their eyes if they could not

think of anymore ideas. She said, “Don’t stay within your school. Go to your house, walk through your kitchen.” She gave her students two minutes to sketch.

After two minutes, students were told to put their pencils down and circle the more interesting ideas they thought others may not have on their sticky notes. Each student was to share those ideas with their partners. They had to not only state what they sketched but to describe the function of that item in a complete sentence. As students shared, Tina went around the various pairs and helped students who had difficulty speaking in complete sentences. After the sharing, Tina asked for responses from various students.

Tina then said, “I want you now to put your brains on big time high alert.” The students’ curiosity was piqued when she stated those words, as they looked at each other and smiled. Tina made reference to a story set in the 1600s that the students had been reading the past few days. She said, “I want you to be the Woods’ neighbor and tell me what they used instead of the gadget that you sketched.” Tina continued, “What creative things did you have in 2014, that instead of that, what did they use? Pick out your sketches and sketch those ideas.” The students were given three minutes to sketch.

When students completed their sketches, they shared them at their tables with four students. Tina reminded them to speak in complete sentences and not simply list the items they sketched.

Summary of Tina’s classroom observations. In the first classroom observation, Tina focused on plot movers of a novel they had been reading. The students sketched

several ideas on sticky notes based on what they read. After sketching their ideas, they shared their sketches orally in their groups. This was the first set of sketches.

For the next portion of the lesson, Tina read a story from a picture novel while the students listened. As part of a memory task, she stopped several times for students to sketch the main ideas they remembered. This was the second set of sketches.

When the students completed their sketches, they looked at both the first and second set of sketches to discover any connections between the main ideas as both novels were set in World War II. Students were required to produce at least five to six connections. They shared those connections with another student by speaking in full sentences.

As for the second classroom observation, students sketched 8 to 10 objects that needed to be plugged in or charged with electricity for it to work. After a couple of minutes of sketching, they circled the items they thought were unique and shared the items as well as their functions with another student. As a further extension to this activity, students were required to sketch ideas on how people in the 1600s could have obtained the same function of the modern items that the students had sketched. The students then shared orally in their group.

In both classroom observations, Tina constantly reminded students to speak in complete sentences. She also reiterated the features of sketches; that sketches only spoke to the students producing them and that there should not be so many details in the images.

Winnie. This was a first grade class learning how to do mindsketching. Winnie explained that she did not start with mindsketching straight away as she wanted the students to get comfortable with drawing first. On the bulletin board, there was a drawing of a girl's face with lots of details like a pony tail, freckles, a hat, and some earrings. The second diagram next to it was a simpler sketch with just the face, eyes, and mouth.

The students were in the midst of sketching using a small white board, a non-permanent marker and clean used socks to wipe any details they did not want. Their task was to sketch things they saw on their way to school. Winnie said, "Sketch the first thing you see in your mind. Okay, now sketch." Once the students completed the sketch, they took turns to share using the prompt–"I sketched a [blank] because [blank]." After the sharing, Winnie said, "Now, sketch the second thing you saw." The students proceeded to attempt the second sketch and followed up with oral sharing of their sketch using the same prompt. The repeated activity of sketching and sharing went for another three rounds.

For the next part of the lesson, the students had a memory game. As Winnie explained later, she had a memory game every afternoon between lesson periods. Since mindsketching was connected with images in the mind to help students remember, Winnie felt the memory game was a natural progression to help her students build memory.

The students sat in a circle and they had to think of numbers up to 20. Before the game, Winnie asked, "When you think of memory, what do you think of?" The students

chorused, “We think of our heads.” Winnie replied, “Yes, think of the number in your head. See it in your head.” Winnie then instructed students to use the prompt: “My favorite number is [blank]” and to speak in a complete sentence.

The first student said,” My favorite number is one.” The second student continued, “My favorite number is one and eleven.” The third student then continued, “My favorite number is one, eleven, and fourteen.” Therefore, every student had to repeat the previous numbers and then add their own. There were a total of fifteen students, excluding Winnie, who also participated in the game. Once all the students had a turn, the next memory game focused on colors. Helen told the students, “Okay, we are doing colors now. Hold it in your memory. Do not use the word light, so no light blue or light green, okay?” The memory game then began, this time, the last student who had to repeat all the previous responses, had the opportunity to go first.

After the game was over, Winnie ended the lesson by saying, “What happens when you have memory?” The students spoke in unison, “It makes us remember things.” Winnie continued, “What does memory do?” Again the students chorused, “It makes me smarter.”

After the lesson, Winnie explained that students had previously done warm-up activities on sketching, such as places you find numbers, or things that were blue. Thus, the memory games were connected to what they sketched earlier. Further, Winnie shared that asking questions like “What does memory do?” serves to boost her students’ self-esteem. She explained that her students came to first grade not feeling smart or

competent enough. This was her way of telling them that they were all capable of good work.

Summary of Winnie's classroom observation. Each first grade student used small white boards and non-permanent markers to practice mindsketching. The students sketched what they saw on their way to school. As they sketched, Winnie checked to see if they were adding more details than they should. If they did, they were encouraged to clean off extra lines using a sock.

Once they sketched one image, the students took turns to describe their sketches, using complete sentences, with the help of a sentence prompt. After the oral sharing, students proceeded to sketch the second thing they saw on their way to school and an oral sharing ensued. The students were given five seconds to sketch each time.

To reinforce their memory, Winnie engaged her students in a memory game. The objective of the game was not only to help students remember, but to get them to articulate in complete sentences. The memory game was designed such that the concepts they were to remember connected to what they learned previously. In this case, they learned numbers up to twenty and the different names of colors.

Data from Workshop Session on Mindsketching

Apart from interviews and classroom observations, the researcher also attended a workshop where teachers trained in mindsketching from various elementary schools worked collaboratively on classroom syllabi incorporating the use of mindsketching in diverse subjects. The researcher sat with a group of second grade teachers who worked on how to infuse mindsketching into the poetry curriculum.

Mindsketching activities. The following is a list of mindsketching activities for poetry lessons in no particular order of importance.

1. Make a sketch of anything in the poem that rhymes with ___.
2. Sketch things that have a long ‘ahh’ sound / long ‘oo’ sound / short ‘a’ sound.
3. Make a sketch of what you can feel / touch / taste / smell.
4. What image in your mind was created as you read the poem? Sketch that image.
5. If there are pictures accompanying the poem, the teacher would remove the pictures so that the students can sketch their own images.

Building complex language. The following is a list of mindsketching activities to specifically build complex language.

1. When I read these words in the poem: ___, ___, ___, ___, they remind me of ___.
2. Other words for ___ (word in the poem) are ___, ___, ___, ___.
3. Other words that are opposite of ___ (word in the poem) are ___, ___, ___, ___.
4. If I were (character/object in the poem), I would ___.

Emergent Themes from the Study

Three major themes emerged: 1) an in-depth understanding of mindsketching is necessary for purposeful implementation; 2) mindsketching encourages metacognition; and 3) visual thinking is an integral part of learning.

Emergent theme 1: An in-depth understanding of mindsketching is necessary for purposeful implementation. The first theme centered on the participants' observations, insights, and perceptions on how their use of mindsketching evolved over the years. During their early implementation of mindsketching, they used the strategy in rudimentary ways: starter or sponge activities or warm-up games before the lesson proper. However, students began to exhibit understanding of information through their sketches, the teachers realized that mindsketching, if incorporated purposefully into the lesson, may be an effective aid to help their students academically. For example, Beverly recalled her own experience on how her use of mindsketching evolved:

> Before, mindsketching used to be like a fun activity for the students… Mindsketching now is no longer a game. It is actually part of their learning. So, the mindsketching moved from a game to actually being part of their learning. And that helps a lot. So, I think it [mindsketching] has grown a lot.

Tina also noted her growth in her use of mindsketching. At first, it was simply used as a warm-up activity, but now, she used mindsketching as an integral part of her teaching repetoire. She shared:

> Before, mindsketching really wasn't connected to the curriculum, other than like fun warm-up activities. I'd ask things like, 'How did you get ready for school?' That was one. Oh, and sketch things that are red. You know, simple things like that. Just to get them to sketch and talk about them…Now, mindsketching is really something we cannot do without…you know, like a lifeline.

Two key ideas were pivotal in this theme: First, the teachers' use of mindsketching evolved because as they incorporated mindsketching more extensively into their lessons, they discovered the adaptability of the strategy. This discovery led the teachers to find myriad ways to weave it into their teaching practice in a purposeful manner. Second, the teachers began to add their own twist to mindsketching. They added their own personality and flair to the strategies as they responded to how their students experienced success in using mindsketching.

With regards to the first key idea of the various uses of mindsketching, the teachers noted that mindsketching could be used to surface prior knowledge of students. In order to introduce new content and concepts, the teachers believed that they needed to activate students' relevant prior knowledge so they could build on that knowledge base productively. For example, Deborah, in her fifth grade language arts curriculum, needed to find out what her students understood about fairytales. She explained:

> …I ask for their schema on fairytales, so this is where we begin our chapter, but prior to that, I wanted to understand what they knew about fairytales. So I said sketch as many things as you can tell me about fairytales.

Apart from language arts, Helen used a silhouette of a head for students to sketch "what was in their heads" in her second grade science and math classes to assess if they understood concepts such as *multiplication* or *division* in math, or the different kinds of movement in science. In social studies, Tina had her students sketch what they understood about the concept, *freedom,* when dealing with stories of World War II. Teachers in this study tested students' prior knowledge by using mindsketching to see if

they understood abstractions such as *fairy tales, multiplication, division,* and *freedom.* In addition, the teachers believed that the process of activating prior knowledge built additional linkages to existing prior knowledge, thereby aiding the integration and retention of new information. Such linkages were deemed necessary for students to make sense of abstract concepts across the various disciplines in the academic milieu.

The teachers also used mindsketching to review what their students learned and to help them consolidate new material with prior knowledge. The teachers in this study believed their students from poverty had difficulty remembering information because structured learning demanded verbal processing. Helen explained how she used mindsketching as a form of review:

> I had them sketch five things that they had learned after covering the material. Because I said, 'I want to see what's in your head. If I see what's in your head, that's going to help me figure out what kind of connections you're going to make or what you know.' This is how you make connections in lessons.

Other teachers, like Cheryl and Rosalind, arranged their students in pairs so they took turns to sketch and talk about their sketches. This built an accountability to each student in the pair in their own learning process. Rosalind explained:

> …now they've done the talking and sketching together and they were allowed to talk about what they thought was important. And then we would usually do a whole class share. 'What do you think was important? What do you think the three most important things were that you chose? Did anybody miss anything? Do we have a big understanding of what we've done?'

Together with mindsketching and verbalization, the teachers observed that they were able to tell whether their students understood what they were taught because as Rosalind suggested, "…the kids who really grasp it [the content] are able to create a sketch."

Mindsketching was also used for assessment purposes. The teachers adjusted their assessment procedures to incorporate mindsketching into the actual assessment. One insight the teachers had was that since they used mindsketching to teach academic concepts and content, the form of assessment should also incorporate mindsketching. They found that mindsketching helped students retrieve learned information more effectively.

For some of the teachers, mindsketching in assessment entailed not just writing out answers to questions posed in the assessment, but having sketches to help students provide those responses in the first place. Tina shared that her assessments for social studies "have more than one piece." It consisted of short essay questions but there was also a section where students sketched their responses and used those sketches "to support their writing." She shared:

> I could tell right away who has that concept…If you're trying to mind sketch an idea, it becomes very apparent if you've got nothing. If your mind is blank and you've got nothing, then you need to still be studying that area.

As for Rosalind, she transformed her assessment exercises from formal questions to quizzes that were more formative in nature. She observed that mindsketching was an "excellent strategy" to check on her "…students' process in their learning…". For

example, she shared about assessing her students' understanding when reading assigned novels:

> It takes more time that I would like to give, to give a full quiz every day but now I tell them, 'Sketch the five most important things you think you should have learned from the reading last night.' And then they're doing their partner share, [and] I can be listening for who seems to be putting too much gloss on it.

Others, like Helen, found that assessments need not be formalized and could be easily executed when opportunities for assessment presented themselves. She shared about assessment in her science lesson:

> I remember…we were observing the clouds. We discussed the different types of clouds. I did it for a week…Then, one day, I just gave them some sticky notes and I said, 'Okay, I want you to quickly sketch me a cumulous cloud; I want you to quickly sketch me a stratus cloud.'

The sketching was followed up by students explaining to their partners the characteristics of such clouds.

As mindsketching became more integrated into their own teaching practice, the teachers alluded to the notion that mindsketching was a teaching tool that could be easily adapted to cater to the learning needs of students, not a program per se. Rosalind noted the versatility of the tool:

> What I really like about mindsketching is that it lends itself to adaptation so well. If it had been rigorous and very prescriptive–first this, second this, and this is how it always is, then it would not have appealed to me. And then I probably

wouldn’t have used it. But because you can take it and adapt it and use it in so many situations, it really works for us.

Because of the adaptable nature of mindsketching, the teachers expanded their uses of mindsketching by concocting their own strategies to work in tandem with mindsketching. Cheryl explained how mindsketching integrated very well with whatever pedagogical practice she employed:

> …it [mindsketching] didn’t seem like another program or a fly-by-night thing that was coming. It was more something that I could just incorporate into my normal day and adopt as good practices, not as a new program…So if I want to do problem-based learning and that’s the way I teach, then mindsketching is just a different way of using it…Adjust it to how you’re going to use it in your way of teaching…

The rest of the participants reported similar insights about how mindsketching could be incorporated into any existing pedagogy. For example, Cheryl used learning centers in her second grade class where students were engaged in different learning activities in each center. As her students became more familiar with mindsketching and experienced success academically, it dawned on her that she could engage her students in mindsketching activities in a learning center situation. She recalled:

> At first, I didn't use it [mindsketching] for the learning centers and I thought, 'Wait a minute, why am I not using it?’ For some reason, I limited myself too much, and now I'm realizing, 'No, don't limit yourself.'…Mindsketching is just another tool in your toolbox. Don’t see it as a program…

Others, like Deborah, Winnie, and Rosalind, consistently used role-play in their teaching of abstract concepts before mindsketching. Deborah explained that in her fifth grade history class, students were engaged in role-play to help them remember historical events. Since the advent of mindsketching, she observed her students could make several connections to the role-play with their sketches, and ultimately, to their writing assignments. She said:

> We first acted it out before they sketch…After we discussed it [role playing], then we will sketch so that way, their sketch would have a connection point, especially when it came to something like a war or battle…when we had one person to be a Texas soldier and another one to be a Mexican soldier, they had now that visual in their head [sic] to where they could sketch that little battle.

Rosalind also used role-play when teaching fractions. She recalled how before, when the students were asked to sketch *one fourth* without any role play, students produced "a lot of dot matrix things, but that didn't always mean that they understood it." Thus, she engaged students in role-play or physical activities using their bodies to explain a given fraction. Another example was how she taught place value using different-sized chairs. She recalled:

> Because the kids who don't understand place value, they see that the numbers go in order but they really don't understand why the lower numbers are on the right and the higher numbers [sic], and that it's more of a matter of a greater value or it having more power and so, I didn't start with a sketch.

When Rosalind used chairs to explain the concept of *power* in math, students understood the concept and transferred their understanding into a sketch. Others, like Helen, used manipulatives to teach mathematical concepts and simply added the mindsketching component to help her students reinforce concepts learned.

The teachers in the study were aware that their elementary school students had to deal with abstract language when describing objects or narrating past events. They found that when they introduced activities that were concrete in nature, the mindsketching strategy seemed to be the bridge from the concrete to the abstract, making learning possible for their students.

Besides incorporating mindsketching into their existing teaching practice, the teachers were also responsive to how students actually used the sketches they produced to aid in information retrieval from their memory. When the teachers initially started using mindsketching, students had to sketch very quickly and with minimal details to capture the images they had in their minds' eye. When students produced the sketches, they were able to explain their sketches, but as time progressed, they had difficulty trying to recall what their sketches signified. As Tina put it: "A mindsketch loses its power if it doesn't talk to you after two days." Deborah shared her insights about her students requesting to add a few more details to help them remember long after they made the sketches:

> When we decided to keep the sketches and use them as triggers, I found that many of my students could not remember what their sketches meant long after

> they did them. Then I decided, okay, I can allow a few more details in their sketches to help them remember or even recall…

Beverly, Cheryl, and Deborah also shared that at first, students sketched to help them visualize what they learned, but increasingly, the sketches were also used as aids to recall learned information after a long period of time. Before, the sketches were thrown away after the lesson, but the teachers now discovered the value of getting students to keep the sketches in notebooks so they could use the sketches as triggers to recall what they learned. Using the sketches to aid memory was the teachers' way of engaging students productively for successful information recall. As Deborah observed:

> I used to display the sketches on the board, and the next day something will happen, and they would just be there. Sketches would be falling and we would never go back and re-visit. It was a waste…I later began to understand how the sketches could be used in a different way, in a better way, to help my kids remember.

The teachers shared that in their current practice, they let the students sketch a little longer, but they discouraged the students from drawing superfluous details. Beverly explained:

> We talk about sketches, that they usually don't have a lot of detail [sic] but if you need to put a letter or a number in there, you can. It's okay because it is yours. So, I always tell them that and I know that they start drawing hair and stuff like that. I was like, that's not needed, but as long as they are able to know what their

sketch means, it's okay with me…And certain sketches need more detail that others, especially if they're really complicated words.

As a result of the usefulness of adding a few extra details in the sketches, some teachers further incorporated activities into their teaching where students were required to refer to their notebooks containing their sketches in order to reinforce their learning. Deborah, for example, found the value of keeping the sketches in their notebooks:

> …They have a notebook where they have their vocabulary word, their sketch…and then the key phrase. And then they would use that notebook for their writing.

The use of mindsketching in the classroom expanded as teachers gained more understanding of the tool. When the teachers' comfort level with using mindsketching increased, the students embraced its use for comprehension and memory.

Emergent theme 2: Mindsketching encourages metacognition. The teachers observed that as they continually used mindsketching, their students became more aware of their own understanding as their minds made connections across different subjects. Teachers in this study provided opportunities for students to transfer their understanding to a different context in another subject. Rosalind provided an illustration of metacognition at work when one of her students made a connection with science and social studies when he understood the word "neutral":

> …I had a student who realized, because we'd talked about Switzerland remaining neutral and the neutron did not have a positive or a negative charge and one of the kids actually made that connection… That's quite interesting, isn't it? The

> kid sketches a neutron and then comes across this word neutral and how that sketch is similar or different to that one… I had a good couple [sic] days overall just because you work so hard to get them to start making those connections. Before, they were very compartmentalized. They really did think that what they learn in science does not bleed into math, does not bleed into social studies.

Apart from making connections within the curriculum, the teachers also observed that their students were engaged in metacognitive processes as they started to notice abstract concepts at work in real-life. Cheryl shared one of her students' stories as she learned the concept of *addition* in second grade:

> So, like one of the girls was sketching addition and she says, 'Well, went to the grocery store the other day. And so my mom was putting things on conveyor belt. And she didn't say that but 'on the little thing that…moves along'. And she says, 'And so she put some flowers on there. And then she put the soda on there. And she put the meat on there.' She was actually adding. I was happy that I got my students to notice anything, because most of the time, they don't notice what's right in front of them. But she was learning and linking.

Another instance of metacognition was when students were taught how to keep track of their understanding of an event in a novel. Tina observed when her fifth grade students experienced difficulty sketching certain portions in the text, she helped them to get back on track by encouraging them to locate obstacles or uncover confusion that hindered their understanding. She shared:

> ‘You know what, guys, let’s go back two chapters and will you quickly discuss what was happening to our main character when he first started having difficulty with this antagonist? When he first had problems with his uncle? Go back and revisit those previous sketches you made. And then, see what you are missing and then we’ll go ahead in chapter four and see what new information you have. Sketch that new information that you may have missed out…’

As a result of their students’ propensity to be engaged in metacognitive processes, communication with their students, such as instructions, explanations, and affirmations, took on a metacognitive bent. Before, when students were engaged in mindsketching, the teachers’ instructions were rudimentary; simply telling them to make a sketch. However, their communication with students about mindsketching grew to be more sophisticated and creative. For example, Tina explained how she reminded her students about the sketch being something that was personal only to them. She explained:

> …I tell them all the time. ‘It [The sketch] doesn’t talk to anyone but you. I don’t have to know what it says. You have to be able to put words into it. So, the sketch only talks to your brain.’ I say that a lot. ‘The sketch only has to talk to you.’

Deborah, too, shared about how her explanation about mindsketching altered:

> So, I have developed strategies on how to explain mindsketching to them to where they will understand it as not just as a strategy but more of a process that needs to occur in their learning. Yes, before I would tell the kids to sketch a little

> picture…but they wouldn't have understood the 'why' behind it. So I think I've kind of formed it into my own where I developed little definitions for it on my own.

Deborah consistently asked her students, "Whose brain does it talk to?", to remind them that the sketches should only be meaningful to them, and not to others. Further, she explained to her students that the sketches were "From your brain, to your sketch, to your mouth", indicating that once students completed their sketches, their next task was to talk about them since no one else knew what the sketches meant. Tina constantly asked her students if they had a "mind movie" as they were reading. She shared how she explained the importance of mindsketching to help them understand a text they were reading:

> Because once it [their mind movie] stops, you have no picture in your head. Then that means you're disconnected, you're unplugged, you need to raise your hand and you need to stop me in that moment once you don't have that picture. Yes. It's got to be constantly going. The minute that you don't have the picture in your mind, you know that you got to get back on the train.

For Tina, the students understood that if they did not have a "mind movie," they encountered a gap in their learning process.

Cheryl also observed that when the students were engaged in mindsketching, she told the students to not only focus on what they were learning, but on how they learned– a practice grounded in metacognition. She shared:

> And I told them, 'Remember we talked about the more you touch things, see things, and say things, you'll learn more. I said, 'So, when your finger touches that sketch and you've spoken the sentence to your partner, the next time you touch that, you don't think it's important but your brain remembered. It connected to your brain. So, when you touch that, you'll remember the sentence.' So, now they know. They just go, 'Oh, I told my partner this. I know what this sketch says to me…'

Other teachers devised their own explanations to encourage their students to produce their sketches. For example, Helen would ask her students, "Where do you have your ideas?" and they would respond, "In my mind." Then she would get them to sketch by saying, "Okay, close your eyes to see your ideas. Now open your eyes to sketch your ideas from your mind." Cheryl had her own "mantra" when praising her students when they were able to talk at length about their sketches by saying, "Kiss your brain!" She explained that it was her "…special way to let the students know that they are able to do it…they can think on their own, they are not bad students."

Emergent theme 3: Visual thinking is an integral part of learning. The third emergent theme involved the notion that visual thinking helped and reinforced the learning process. All the teachers in the study shared their early experiences of using some form of visualization to help them learn or take notes while they were students. For example, Rosalind recollected her own experiences of using visuals during her student days:

> It [Mindsketching] actually triggered memories in my own note taking in college and in high school because I'm very visual. My own binders and notes, that I would get in trouble for because they weren't neat enough, were filled with doodles and random bits and pieces on the edges. When I was learning how to do mindsketching, I realized that that's what I had been doing all along. So it made it much easier for me to be able to understand how it could be used in the classroom.

Similarly, the teachers observed that if their students did not have a picture or image in their minds, there was a high probability they did not understand the lesson content. Tina summed up this sentiment when describing the kinds of students they face in their classrooms:

> …let's say, the teacher did read to them and it's a read-aloud, and half the time they've got nothing in their mind [sic]. And they're so used to sitting there with a blank slate because that is what they've done their whole school career. It is their natural state of being. I don't have a picture in my head right now. Didn't in the fourth [grade], didn't in third, didn't in second…

On the other hand, when the students did have an image in their minds, the teachers observed that their students had indeed grasped the content as they were able to explain what they learned using their own words, instead of regurgitating what the teacher taught. Cheryl shared how she checked her students' learning through mindsketching:

> It was great this year because we were doing addition and I had taught the unit. I said, 'Okay, sketch for me what addition is.' And you can tell which ones got it and which ones didn't. So, I knew…What I usually do is I say, 'Think of addition. What do you see when you think of addition? Close your eyes, see addition. What do you see?'

Tina also communicated the importance of having a visual while reading a text–having a "snapshot in their minds." She shared:

> If it's a new word and the students do not have an image, I know they will be in trouble. So, we jump into the reading. We read it in context and then we pause and say, 'Okay, now, do you have a mind movie? Do you want to go back and add a sketch?...They need to visualize. They need to see the mill in their minds. They need to see the water wheel in their minds.

The teachers revealed that they used mindsketching more extensively now because their own students indicated to them that without sketching images, they had difficulty understanding the lesson. Cheryl recalled when she taught the content without any mindsketching involved, her students reminded her that they needed to sketch first. She shared:

> …the students would remind me, 'Wait, we haven't done our mindsketches. Can we mindsketch please?' because they struggle so much coming up with the words that they desperately want to mindsketch. To them now, this is completely normal. We mindsketch. And that's just the way things are. This is second grade. These are the little ones.

The teachers also found that mindsketching in itself did not help students build academic literacy. What helped to make mindsketching effective was that students were expected to verbalize their sketches. Cheryl shared her insight about how amazed she was when her students explained their thought processes using their sketches that at first looked meaningless to her:.

> …sometimes I'll look at their sketches and I'm like, okay, and then they tell me the sketch, and it makes perfect sense. But if you looked at it, you would be like, forget it, they totally missed the mark. But they come up with the most ingenious ways of how they thought of it and how why they sketched that image. It's amazing to see how they understand something just from the sketch. To me, it's such a valuable tool to help them see that their thoughts have meaning.

Since the teacher and the other students did not have a clue as to the meanings of the sketches, the students who produced them had to verbalize their thoughts. The teachers noticed that their students from poverty did not have opportunities to verbalize their thoughts in class, either because they did not understand the content, or they were reticent by nature. Mindsketching was a way for them to express themselves and demonstrate their learning in a safe environment. As Tina put it, her students "did not want to speak, but now, they have found their voice and feel empowered…"

As an extension of this visualization-verbalization procedure, the teachers observed that mindsketching must be accompanied by speaking, writing or both−all in complete sentences. To help their students build complex language, students were expected to verbalize their sketches. As Winnie explained, "Only the student that

produces that sketch will know what the sketch is about, so they have to explain it to someone else…" Like Winnie, Cheryl shared her insight on how the sketches acted as bridges to verbal communication:

> I like what my kids say. They say they read their mindsketches. So to them, they're words. If they just have to come up with words on their own, they can't do it. But once they've put their picture in there, they associate it with words and so, they're able to come up with that sentence.

According to Beverly, solely engaging in mindsketching without the verbalization part was not fully utilizing the strategy. She shared:

> The thinking, the sketching, and then you do the talking…the product at the end is a better quality product than if you cut mindsketching or the talking part out. I think the sketching together with talking is a huge key…

Aside from verbalizing what the sketches signified, Winnie discovered that students could learn how to predict events by getting them to sketch on what they thought would happen next. These predictions by the students were then used as leverage to trigger more opportunities for students to verbalize their thinking. She found that in the beginning, her students were silent when she asked them what they thought would happen before she flipped to the next page of the story. At first, she attributed it to shyness, but increasingly, she felt that "their little minds simply do not have a picture in their minds; they are just blank." With the consistent use of mindsketching, students were now comfortable predicting outcomes to a story. There was greater verbal sharing

in the classroom. Winnie observed: “They have the image in their minds, so before they verbalize, they sketch it first.”

All the teachers in the study insisted that their students verbalize in full and complete sentences–a feature of complex language evident in academic literacy. To help their students, the teachers used a variety of sentence prompts to help them speak in complete sentences.

The students were also expected to write in complete sentences, not just words or short phrases. Rosalind reflected on her early use of mindsketching where she did not have much follow-up activities in terms of writing. She recalled:

> I was relying too much on the sketching…I made a mistake with that on one of the novels last year. They had sketches galore and they didn’t know what the sketches meant because there was not enough writing follow-up.

Beverly noted that “…writing is hard to teach…” but since she began using mindsketching, students found it easier to write because they “…just had to put in words…what they just verbalized” through their sketches.

One of the main insights the teachers had about the writing process was the skill of sequencing information. The teachers observed that much of their curriculum content required students to sequence information in any writing task. For example, the teachers found that science presented many opportunities for students to sequence information such as life cycles of a plant or animal, the water cycle when discussing how rain was formed, or the cycle of the four seasons. In social studies and language arts, students

learned how to sequence information by sketching events in history, in novels, or their own stories. Cheryl explained:

> So I use it for writing the same way, 'okay, think of the first thing that happened; the second thing that happened; the third thing that happened,' and they just go back and read their sketches when they want to think of the sentences.

Beverly, like the other teachers, found that sticky notes were invaluable aids to help students in their sequencing process. After getting students to sketch a story relating to a particular theme, they shared their stories with their partners. While sharing, students could still insert a particular detail in a sticky note. She observed:

> They've now sketched their story, told their story, and now they get to actually write their story. So the sticky notes, I find, is an excellent way for organization, definitely organization, but it also helps them to bring their ideas that they want to put in their story.

As a result, the teachers noted a remarkable growth in their students in terms of not only the clarity in their writing, but in their desire to write.

Another piece of the learning process was the role of memory. The teachers agreed that in order for learning to be successful, students needed to build their memory by organizing information in such a way that they could remember it. One way to help build memory was the use of visualization to help students encode information that could be easily remembered and retrieved, especially in the use of instructions to their students on assigned tasks. They found that students had difficulty following and

understanding their instructions. Cheryl explained how she gave instructions differently to her students:

> Give them the steps of what you expect them to do because it was really hard for them, in the beginning, to remember…So then I gave them rules. Step one: You do this. Step two: You do this. Step three: you do this. And that has helped them to remember what to do…

Cheryl explained that when her students had "…numbers in their heads…," they remembered her instructions better. Helen also alluded to the importance of numbering instructions when she stated, "It's amazing how easy it is for the students when you simply place a number before an instruction. What a difference it makes."

In conclusion, the teachers discovered that using visualization in their instruction by way of mindsketching helped their students learn. Tina summed up, "…they're not in the dark anymore. The mindsketching is like the little flashlight in their heads." The teachers found their students to be more engaged in their own learning. Cheryl stated, "…the students are really learning to learn and to be active participants in their own learning...they are no longer passive learners."

CHAPTER V

CONCLUSIONS

This study examined teachers' observations, insights, and perceptions on the use of mindsketching to build the academic literacy of students raised in poverty. Most notably, this study provided a snapshot of a unique instructional tool to assist such students. The research questions which guided the study were:

1. What do teachers understand about the purpose of mindsketching?
2. How do teachers use mindsketching in the classroom setting?
3. What are the changes that teachers have observed in their students since initiating the use of mindsketching?

Research Question 1: What Do Teachers Understand About the Purpose of Mindsketching?

The purpose of mindsketching was to promote productive learning in an academic setting, especially one in which the majority of students were raised in poverty. Mindsketching provided a first step towards engaging the students in their learning process, specifically: 1) having an image in their minds when they understood something, be it concepts or content needed for academic literacy, 2) capturing that image in the form of a sketch, 3) communicating the meaning of the sketch orally, 4) communicating the meaning of the sketch through writing, and 5) recalling what was learned. The learning process using mindsketching appeared to be cyclical in nature and is encapsulated in Figure 4.

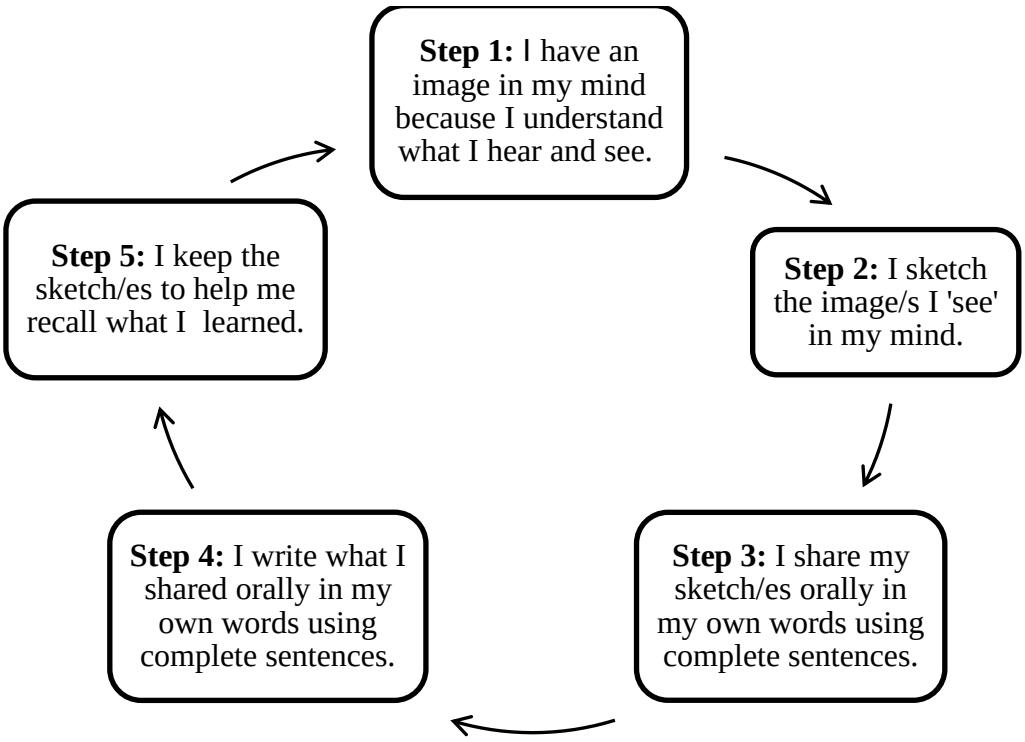


Figure 4. The role of mindsketching during the learning process

Teachers noted that when their students did not fully understand a concept, they had difficulties producing a sketch, or to use Tina's expression, they did not have that "snapshot in their minds." On the other hand, students exhibited their understanding of what they knew or had learned when they were able to produce sketches and then explain those sketches to a peer.

Another aspect of productive learning occurred when students were able to articulate their sketches in their own words using complete sentences. Using complete sentences was necessary as Beverly explained, "Complete thoughts…require complete sentences." For the teachers, mindsketching was a litmus test of checking students'

understanding as there was limited latitude for students to simply regurgitate information. During classroom instruction, the teachers shared that they themselves refrained from doing sketching as they were aware that the students might simply copy their sketches.

However, when the students shared their sketches orally to a student partner, they used their own words, not only to describe their sketches but to explain why they had sketched the images in the first place. Therefore, the students had to articulate their own learning. As part of new understanding gained as a result of peer sharing. Thus, students were engaged in structured conversations that were academic in nature and required sharing ideas, thoughts, and understanding pertaining to specific content topics. By serving as a starting point for academic talk, the sketches enabled students to self-direct their oral discussions.

After the oral sharing, students were expected to write down what they had shared. The teachers recounted that students appeared more comfortable writing as it was similar to oral sharing, albeit in a different medium. Students engaged in mindsketching to enhance their vocabulary and thus, equipped to refine their academic writing. The teachers contended that this process assisted students in making connections between ideas. Rosalind, for example, discovered the power of mindsketching when another teacher friend shared about her woes of student plagiarism in a fifth grade classroom: Mindsketching mitigates plagiarism.

The teachers recognized that in any learning process information has to be remembered and retrieved. Mindsketching provided a way for the students to recall

information more easily as they had to manipulate information through sketching and then explain and write about those sketches. Those behaviors constituted elaborative strategies of learning, wherein visualization and verbal processing aid meaningful processing of information that builds memory (Hodes, 1994; Weinstein & Mayer, 1986). The cognitive ability of retaining and recalling information effectively is not only critical for assessment purposes, but assists students in making connections and building their knowledge base as they move up to higher grades.

In sum, the teachers in the study understood that the purpose of mindsketching was to enable students to take charge of their own learning and become engaged in classroom activities, thus leading academic literacy. As Cheryl pointed out, "Since using mindsketching, they're really learning to learn and to be active participants in their learning…They are excited about learning."

Research Question 2: How Do Teachers Use Mindsketching in the Classroom Setting?

The teachers in the study underwent training in mindsketching but shared that they used mindsketching in a variety of ways, given its flexibility. Mindsketching evolved from a game or starter activity to an indispensable tool that helped students navigate the challenges of attaining academic literacy. It was used purposefully by teachers in their curricula to engage students in higher-order thinking skills. The evolution of how teachers described using mindsketching is shown in Figure 5.

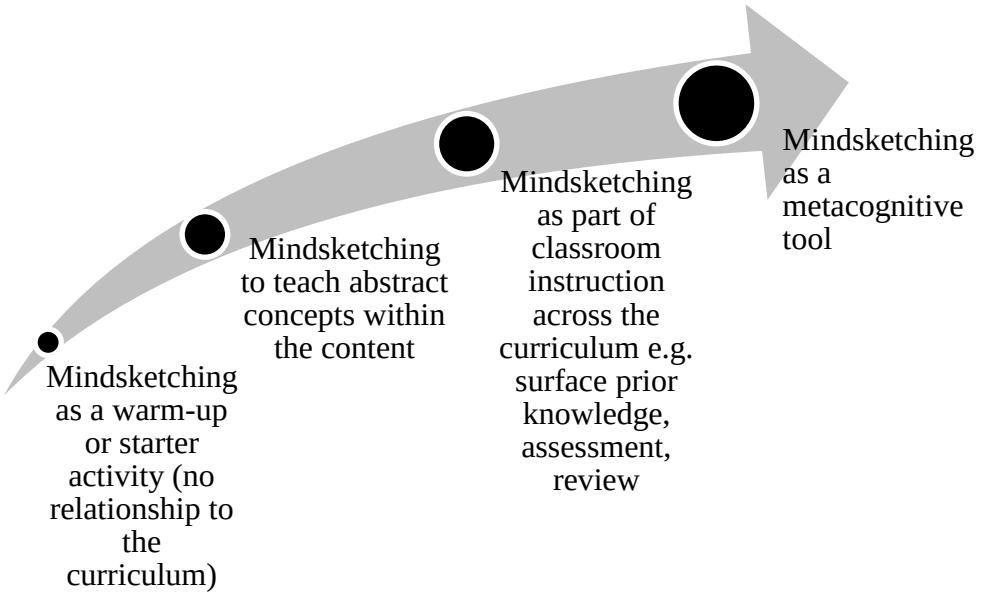


Figure 5. Evolution of the use of mindsketching in the classroom

To increase fluency in mindsketching, teachers introduced out-of-context games and activities for students to gain more practice in sketching. These mostly came in the form of warm-up or starter activities which had nothing to do with the actual content they were learning. Mindsketching, to a certain extent, was successful because student shared what they sketched with their peers, thereby increasing student engagement.

Academic literacy entails abstract and complex concepts that are cognitively challenging. Therefore, mindsketching was used as a tool to help students understand abstract concepts found in content areas–math, science, language arts, and social studies. These concepts came in the form of domain-specific academic vocabulary (Marzano & Pickering, 2005) present in their respective content areas, such as *freedom* in social

studies and *multiplication* in math. Teachers found that negotiating abstract concepts within a content area increased the depth of their students' understanding.

As the teachers unearthed the versatility of mindsketching, they infused it purposefully into their pedagogical practices. Mindsketching was not confined to learning abstract concepts, but was helpful in surfacing relevant prior knowledge, reviewing learned material, and assessing understanding of learned material. Teachers used mindsketching consistently to help students build their knowledge base, and through this process, build their academic literacy. In short, the teachers' focal emphasis in using mindsketching was on the process of learning, rather than the product of learning.

The use of mindsketching continued to evolve when the teachers provided opportunities for their students to engage metacognitively with the content. For example, Tina engaged her students with metacognitive thinking by having them explain their thought processes behind their sketches while reading a passage of text.

In sum, the teachers continued to think about different ways they could use mindsketching in the classroom, such as looking through the curriculum to formulate a list of concepts and academic words that their students should know. Teachers did not change curriculum around the technique but devised mindsketching strategies to help students make meaningful connections between content areas. As Cheryl pointed out, "I don't change what I'm teaching; I just change how I teach."

Research Question 3: What are the Changes That Teachers Have Observed in Their Students Since Initiating the Use of Mindsketching?

Before the introduction of mindsketching, the teachers revealed that their students faced challenges understanding the content of the lessons and rarely exhibited any excitement towards learning. Words like "quiet" and "reticent" were used to describe the students.

Teachers in this study observed several changes in their students. First, they were astonished at how most of their students readily took to mindsketching, and after a few weeks of practicing the strategy, had a knack for sketching their images instead of taking time to draw details. For example, Winnie shared how her students were engaged in several drawing activities. When she initially introduced mindsketching, the students were given the option to draw or sketch. Over time, she found that her students preferred to sketch instead of draw because they liked to explain their own sketches to their partners

Second, the teachers observed that their students were now more engaged in oral activities. They seemed to have found "their voice" as Tina expressed, and wanted to talk about what they learned and share new ideas. Teachers also found students more eager to express themselves using their sketches, enabling instruction to move away from highly teacher-centered to instruction wherein students actively made sense of their own learning.

Third, all the teachers in the study mentioned that one of the biggest changes in their students was that they spoke in complete sentences. Before, students used one word

or short phrases to orally respond to their teachers, but now, they were comfortable speaking in complete sentences. Similarly, for writing, the students often found it an overwhelming task to write, but now, they not only enjoyed writing, but were writing in complete sentences. As a result of speaking and writing complete sentences, the teachers shared that their students showed improvement in their class assignments and tests. They all agreed that there could be other factors that played a part, but they all opined that mindsketching certainly played a "substantial role" (Beverly's words) in their students' improvement.

Fourth, the teachers noted that their students now enjoyed reading. Teachers shared that students often found it difficult to understand concepts in academic books and therefore, disliked any reading tasks. After the implementation of mindsketching, students appeared more comfortable in reading tasks.

Interpretation of Findings

This section presents an analysis and interpretation of the findings in relation to current literature. The findings from teachers in this study who used mindsketching align with several areas of research previously explored in the literature review. These lines of research collectively serve as a contextual framework within which to situate the present study.

An in-depth understanding of mindsketching is necessary for purposeful implementation. Teachers in this study underwent training on mindsketching for a period of two years. As the teachers in the study became more acquainted with mindsketching, they began to purposefully use it as an educational intervention to help

their students build academic literacy. Research studies have shown that educational intervention programs are most effective when they last for longer periods of time (Brooks-Gunn et al, 1994; Nisbett, 2009). This study corroborated those research findings. The seven teachers in the study used mindsketching consistently for an average of four years in their classrooms. As they gained a better understanding of mindsketching, they systematically infused it into their current classroom practices for various purposes: surfacing prior knowledge, teaching abstract concepts, as well as for formative and summative assessments. Professional development for teachers should consist of strategies easily infused within the curriculum and flexible enough so teachers may adapt them to meet students' needs.

Studies indicate that IQ is not fixed and can increase, given the appropriate educational intervention (Brooks-Gunn et al, 1994; Capron & Duyme, 1989; Duyme et al., 1999; Nisbett, 2009; Ramey & Ramey, 1998). Such educational interventions may have the potential to narrow the academic performance gap between low-SES and high-SES children. The results of this study extend research on educational intervention that increases academic literacy, language skills, and memory.

Mindsketching encourages metacognition. In order to foster higher-order thinking skills, students need to become self-directed learners (Ambrose et al, 2010; Harvey & Goudvis, 2007; Johnson, 2009; Palincsar & Brown, 1984). Through mindsketching, teachers provided opportunities for students to become more aware of their own thinking and monitor how they learned. Teachers directed their students' attention to not only what they learned but how they learned. As a result, teachers'

instructions and explanations continually focused on students' metacognitive thinking underlying the sketches. There is a lack of studies on how children from poverty engage in metacognitive practices. The illustration of mindsketching use in this study offers an example of how students from poverty may be encouraged to engage in metacognitive practices.

Visual thinking is an integral part of learning. Over several decades, research has studied the role of visual images that promote children's literacy, particularly drawing images (Alesandrini, 1981; Baghban, 2007; Dyson, 1983; 1986; Johnson, 2009; Kendrick & McKay, 2004; Levin & Bus, 2003; Paquette et al., 2007). In these research studies, students engaged in drawing detailed images to help them understand the content. The present study presents an alternative approach to visual images−using minimal lines in mindsketching to achieve the same purpose. The mindsketching technique supports Paivio's (1969, 1978) findings, which suggested even images with very minimal details could still leave a distinctive trace in the memory−or in layman's terms, to jog one's memory.

Visualization techniques may be particularly useful for children in building complex language, especially children from low-SES backgrounds, who are often at risk for oral and written language difficulty (Burt et al., 1999; Pruitt & Oetting, 2009). Paivio (2008) found that the development of the nonverbal or visual system, reinforced later language acquisition and skill. The results of this study are consistent with the usefulness of visualization to build complex language in academic literacy. The teachers leveraged their students' ability to sketch (a visual skill) to promote academic learning across

content areas various content through development of oral and writing skills−skills within the verbal system.

After sketching, students were encouraged to describe and explain their images in progressively greater detail–from words and phrases to sentences. Applications of a visualization-verbal procedure as part of instruction has been shown to yield better reading and math performance, as well as effective learning of technical content material (Purnell & Solman, 1991; Sadoski & Willson, 2006; Tuley & Bell, 1997). The results of this study agreed with the research cited. Teachers reported that after their students sketched their mental images, they were better able to verbalize those images to their peers using complete sentences. As minimal details were used in the sketches, they were meaningless to other students. The sketches thus facilitated oral discourse amongst the students and fostered understanding of the content.

Implications for Future Research

This study was instrumental in describing the observations, insights, and perceptions of elementary school teachers who used mindsketching to build academic literacy in their students from poverty. Details of how mindsketching was used to build academic literacy in children from poverty could pave the way for similar research-based strategies for the practitioner in the classroom. While this study focused on the experiences of elementary school teachers, another study could be done from the perspective of middle or high school teachers. The results from such a study would inform whether mindsketching might be a viable strategy for students in higher grades. In addition, while mindsketching in this study was explored in typical elementary school

subjects, including language arts, math, science, and social studies, a study in high school subjects such as literature, geography, trigonometry or geometry, would be of interest.

Although qualitative methods were employed in this study, a quantitative study could be designed to explore the effectiveness of mindsketching for students from different socio-economic backgrounds. Test scores of students who used mindsketching within a given content area could be compared to students who did not. The data, together with data derived from qualitative studies, could provide more information on how the deliberate use of mindsketching supports the academic achievement of students.

Some teachers trained in mindsketching did not utilize the strategy at all. It would be interesting to study trained teachers who chose not to implement mindsketching in the classroom. In addition, studies on why some teachers become high implementers of this tool while others are not could advance the research on teacher implementation of classroom strategies.

Implications for Practice

Students from poverty face obstacles in building a verbal language base that can help them to succeed academically. Mindsketching brings a visual component to learning and helps students build connections from images to words. It can assist students in improving their language skills−from simple words and short phrases to complete and complex sentences using descriptive language. As a start, students can be trained to use mindsketching by encouraging them to sketch things they see around them, such as things they find on their way to and from school, things that are round, or

things that make sounds. As they become more comfortable with sketching concrete objects, they can be encouraged to sketch abstract concepts with the purpose of expanding the use of verbal language.

In addition, students naturally make connections between what they know and what they are going to learn. These connections form knowledge structures that are meaningfully organized, so that students can retrieve and apply their knowledge effectively. Mindsketching can help students effectively connect new knowledge to previous knowledge to enhance learning. Teachers can engage their students in mindsketching to understand what students know−or think they know−to help them design classroom instruction more appropriately, by identifying and actively filling in the gaps to correct students' misconceptions.

Underlying mindsketching is the notion of visualization-verbalization procedures. After every mindsketching activity, teachers can provide their students with conversational opportunities for targeted oral practice. Combining sketches with verbal elaboration, in turn, can further enhance students' learning in areas such as vocabulary, reading comprehension, and writing.

Conclusion

Roadblocks to academic achievement have been of great concern to educators and administrators who work with children raised in poverty. Before they enter school, students from poverty face overwhelming odds. Once in school, poverty continues to compromise their ability to learn when they are at a disadvantage in academic literacy.

The study described seven elementary school teachers' observations, insights, and perceptions on using mindsketching to build academic literacy of their students, the majority of whom come from poverty-stricken backgrounds. Using naturalistic inquiry, data were obtained from face-to-face interviews and classroom observations. Constant comparative method and thematic analysis were used to analyze the data for emergent themes.

The overarching research question in the study was: How do teachers use mindsketching techniques to build academic literacy of their students raised in poverty? Three emergent themes resulted from the study. First, the teachers observed that an in-depth understanding of mindsketching was necessary for purposeful implementation. At first, they used mindsketching as introductory activities before teaching the content. However, as they recognized the versatility of mindsketching, they used it as a teaching tool for various instructional practices, such as assisting students to connect new information to prior knowledge. Second, the teachers noted that mindsketching encouraged metacognition in their students. Mindsketching allowed the students to be engaged in metacognitive tasks such as monitoring their own thinking as they learned the content. In addition, the teachers found that mindsketching could provide opportunities for students to transfer their learning across different content areas. Third, the teachers in the study found that visualization provided an initial step towards engaging their students to learn productively. Mindsketching, as a visualization tool, helped their students to build complex language and understand abstract concepts.

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APPENDIX A

INTERVIEW PROTOCOL

No	Interview Question	Purpose	Research Question (RQ)
1	What were some of your thoughts when you were going through the first professional training on mindsketching?	This was a grand tour question to make participants feel at ease. This allowed the researcher to understand how participants felt in learning a new strategy like mindsketching. The researcher would also be able to understand how the participants got involved in the training in the first place – was it mandatory or voluntary? (If this information was not forthcoming, I used a prompt, "How did you get involved in the training on mindsketching?") It provided the researcher a glimpse of what participants used to do before they learned mindsketching. (If this information was not forthcoming, I used a prompt, "What teaching strategies did you use before your training in mindsketching?")	

No	Interview Question	Purpose	Research Question (RQ)
2	What is mindsketching? (or your understanding of mindsketching?)	Researcher sought to understand teachers' knowledge of mindsketching and its purpose.	RQ 1: What do teachers understand about the purpose of mindsketching?
3	What are some of the ways you have been able to use mindsketching while teaching different content subjects? Describe these ways in a sequence so I can understand what you did exactly.	Researcher sought to find out the various ways that participants used mindsketching in their teaching in different content subjects apart from language arts.	RQ 2: How do teachers use mindsketching in the classroom setting?
4	What did you find effective or successful early on when you first used mindsketching?	Researcher sought to find out how mindsketching was useful for the students.	RQ 2: How do teachers use mindsketching in the classroom setting?
5	How has your implementation of mindsketching strategies changed over the years?	The researcher sought to find out teachers' growth of expertise in using the strategies over the course of two or three years. (If this information was not forthcoming, I used a prompt, "Compared to your first year of using mindsketching and using mindsketching now, what kinds of changes have you seen in how	RQ 2: How do teachers use mindsketching in the classroom setting?

No	Interview Question	Purpose	Research Question (RQ)
		you use mindsketching in the classroom?")	
6	Can you share some of your success stories in using mindsketching?	Researcher sought to find out individual stories of success.	RQ 3: What are the changes that teachers have observed in their students since initiating the use of mindsketching?

APPENDIX B

CONTACT SUMMARY SHEET

Name of participant: Deborah **Date / Time:** 22 May 2014/ 10.00.am. – 11.10a.m.
Site: X School

1. **What were the main points or emerging themes that struck you with this participant?**

- MS (mindsketching) makes sense as Deborah used visuals for note-taking
- MS not just an add-on to teaching but embedded in the practice
- Students engaged in oral activities that require them to speak in complete sentences
- Comes naturally to Deborah (may not be indicated on the lesson plan) but can be used 'on the spot'
- Some departures from the actual training e.g. no pointing to sketch, add enough details to sketch to help students remember long after the sketch is made
- Have other activities in addition to MS to help students remember info better
- During classroom observation two days ago, noticed that Deborah used "mantras" or little sayings to help students with MS e.g. "From your brain, to your sketch, to your mouth," "Let your brain talk to you." (these was not taught at the MS training)–responsive to students' understanding of MS?

2. **Summarize the information you received / did not receive for each of the interview questions for this participant.**

- Managed to ask all the questions in the protocol
    - ✓ Volunteered to attend MS training
    - ✓ Provided examples of MS in history and vocabulary
    - ✓ MS not a stand-alone activity but used seamlessly with other activities
- Check with Deborah about students who find sketching difficult, meaningless, waste of time?

3. **What new questions do you have for the next participant?**

a) Do you have students who find MS difficult? If yes, how do you manage such students?

b) Do you have your own “mantras” or little sayings that you use over and over again to help your students have a better understanding of MS? How did you come about using them?