A Classroom Based Assessment in a High School Social Studies Classroom

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A Classroom Based Assessment in a High School Social Studies Classroom

by

Sam Busick

A dissertation submitted in partial fulfillment of the requirements for the degree of

Doctor of Education in

Leading and Learning

University of Portland School of Education 2018
A Classroom Based Assessment in a High School Social Studies Classroom

by

Samuel R. Busiek

This dissertation is completed as a partial requirement for the Doctor of Education (EdD) degree at the University of Portland in Portland, Oregon.

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12/14/17

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1/16/18

Dean of the Unit

Date

12/14/17

Dean of the Graduate School
Abstract

The purpose of this study was to investigate whether the use of brain-based pre-writing strategies will improve students’ abilities to support claims, with evidence, on a state-mandated, classroom-based, assessment. Specifically, the research evaluated the working hypothesis that using brain-based, pre-writing activity in the non-fiction, expository writing process will assist students in their performances, as assessed by the Office of the Superintendent of Public Instruction for the state-approved *You and the Economy* CBA Rubric. By using brain-based strategies as a pre-writing activity in the non-fiction, explanatory, secondary social studies writing process, I hypothesized that those students would demonstrate logical use of claims and evidence in their typed essays.

The research questions were answered through an action-research data cycle. This research is guided by two overarching research questions:

1. As brain-based learning strategies are being implemented in real time, what is the nature of the process of using brain-based interventions? In documenting the brain-based interventions, what decision-making factors are considered when designing the unit of instruction?
2. What changes—if any—are demonstrated in student writing performances on a Classroom Based Assessment, when brain-based learning strategies are implemented over the span of the research cycle?

These research questions were answered through a study design involving a cycle of instruction, culminating in an explanatory writing sample. The results of the CBA-related to claims and evidence outlined in EALRs 2.2.1 and 5.2.2, instructional practices to implement brain-based pre-writing strategies will be implemented. Using brain principles to increase visual, auditory and kinesthetic contact with the concepts presented may improve students’ abilities to make claims and provide proper evidence for those claims, as measured by the Office of the Superintendent of Public Instruction for the State approved *You and the Economy Class Based Assessment* (CBA) Rubric. The process of my decision making, as well as student writing, was examined to evaluate the effect of brain-based pre-writing strategies, which students use to complete the CBA.
Acknowledgments

I would like to thank my wonderful wife Nicole, amazing son Henry and precious daughter Emma, who have graciously allowed me the time away from their pleasant presence to work on, work through and complete this research project. To my dedicated father Steve, doting mother Peggy, and loyal Brother Joe, I thank you for all your moral support and guidance. Much appreciation to Maggie Brown, for editing this work, and helping me through this process. I am very grateful for the guidance from Bruce Weitzel and my dissertation committee, James Carroll, Julie Kalnin and Eric Anctil. To my students, my colleagues, all teachers, my friends, and to the University of Portland, my sincerest gratitude, thank you!!! Without all your support, encouragement and love, this research would not have been possible.
Dedication

This research is dedicated to my Grandmothers, Mildred Stevens Busick Davis and Elizabeth Emma Nellor Larson.
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Chapter 1: Introduction

The Nature of Writing Assessment in American High Schools

The proliferation of student assessment at all levels of education in the United States of America has caused each state to enact an assessment of the writing of each social studies student. Invariably all these assessments include a long form essay question, asking students to make claims and back them with evidence (Brookhart & Durkin. 2003; Linn, R. L. 2005; National Center for Education Statistics, 2012; Payán, & Nettles, 2008). In every state in America, and in every social studies schoolroom, there is now a rubric that is based on citing claims with evidence (National Center for Education Statistics, 2012; National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010a). Since the Common Core Curriculum has been implemented, students throughout the country are being taught evidenced-based writing strategies (Brookhart & Durkin. 2003). An examination of the many assessments which states use to demonstrate student proficiency, indicates an expectation for our high school graduates to be able to write, making claims, and providing adequate evidence to substantiate those claims.

Given the uniformity of these writing assessments in American education, it is vitally important that we discover best practices, which will allow all students access to these formal tasks. High stakes testing, graduation-based assessments, are relatively new public policy in education, and require the close look that this study will provide. According to the 2012 National Assessment of Educational Progress, (NAEP), writing assessment at the 12th grade level showed just above a quarter of the students scoring Proficient. The 2012 NAEP assessment included explanatory and narrative writing
essays administered to 24,000 12th grade students. The assessment demonstrated that just over half performed at Basic level, and just under a quarter of the population performed below Basic level (National Center for Education Statistics, 2012).

**Contemporary World Problems (CWP) Professional Learning Community**

Over the last three years, our social studies department, described in this study as a Professional Learning Community (PLC), has studied results of a state-mandated writing assessment, and has identified specific trends in students’ responses. My colleagues in the district are also finding that many students have a hard time expressing themselves in formal writing, in response to state assessment standards. Our students’ scores have demonstrated that, while students understand how to make claims and cite evidence to support those claims, students struggle to evaluate the evidence, which they have provided to support their claims, in order to ensure that the evidence supports the claims made. In the last three years, the overall trend in scores at the school where the study was completed reveals that certain sections in the assessment, which highlighted claims and evidence management, averaged lower scores than other sections of this assessment. There is a four-tiered model of expectation, which my social studies PLC experience mirrors on a yearly basis, the district, state, and national trend. A quarter of the students in our classes produces quality writing, a quarter struggles to accomplish the required tasks, and the majority are somewhere in the middle (National Center for Education Statistics, 2012).

In response to these data, three teachers in our building teach our Contemporary World Problems (CWP) class, and comprise our CWP PLC-identified, content-based interventions targeting student achievement, in the specific area of making claims in
written assessments, and in backing those claims with valid and adequate evidence. The goal of this study, and our PLC work with adolescents, is to strengthen and expand students’ abilities to substantiate their claims with evidence. Research in brain-based learning suggests that, presenting classroom material to students with an understanding of how adolescents learn to use language, spoken and written, is important, and on the forefront of research in the field of Education. Engaging adolescents in learning how to present claims, and provide evidence to substantiate those claims through writing, improves students' cognitive abilities. This study uses brain-based pre-writing strategies to improve students' performances on the *You and the Economy* CBA in general, and specifically develops the criterion for linking claims to evidence.

**Features of the Problem**

The most prescient problem today, in high school social studies classrooms, is how to motivate students to complete formal tasks, such as classroom-based state assessments, in order for students to demonstrate proficiency in writing. In order to successfully complete this task, claims and evidence must be linked, presented and understood in writing. The specific interventions that were researched in this study were intended to help students tie claims to evidence, in writing. Moving from concrete to formal thinking is the goal for all adolescents. To this end, one of the best ways we can assist students is by targeting the ability of students to make claims, and to cite those claims with appropriate evidence, in an expository essay. The production of this task demonstrates the ability to think formally about the world, and to think about the thinking of others, all hallmarks of formal thought.
**Brain-Based Interventions**

The theoretical background of this study is steeped in cognitive psychology. Scholars of cognitive psychology describe human neurobiological processes such as thinking, learning, speaking, and acting, as primary functions of the environment which individuals inhabit. Cognitive psychology describes how we organize western society, and how individuals react to that society, all while we are replicating or modifying that culture. Through the deep study of the structure of language or linguistics, these scholars give us an understanding of ways in which people exist, in a multitude of language backgrounds, which affects each person uniquely.

Students' writing processes are enhanced when students can literally see what they think, and seeing those concepts, on paper, in their drawings, connects them to the subject in a way that activates their visual cortexes (Baars & Gage, 2010). As students illustrate their thoughts, the interaction with visuals informs students’ thinking, and in turn, their writing (Arwood, 2011; Doehrmann & Naumer, 2008; Gallese & Lackoff, 2005). In this way, concepts are made clear, facilitating the addition of new information, and forming a more refined and more deeply understood concept (Piaget, 1959). Many studies show that the use of visuals by students has a positive impact on the student writing process. In order to access visual memory centers of the brain, and to create visual depictions of learners' concepts through drawings, learners must access their concepts in a visual manner, and see them on paper (Arwood, 2011; Doehrmann & Naumer, 2008; Gallese & Lackoff, 2005).

Producing visual images layered with sound is even easier for the brain to process, and this approach provides more information than listening alone, or seeing
something out of context. Much of the difficulty adolescents face is in turning reading into writing, rather than audio-visual information into pictures, and then drawing. Presenting audio-visual information to students provides images, which can boost adolescent concepts, and an understanding of the interplay between concepts. Writing about images with sound allows for the learner to get more information out of the stimulus. Essentially, the more access points whereby maximum information can enter the brain, the easier it is for the brain to assimilate and code that information (Baars & Gage, 2010). Brain coding allows humans to process and make sense of the given stimulus. It is then possible to name it with language that enhances understanding, and to check that understanding with others. Receiving feedback that informs, or changes, that original thinking means the stimulus has become a concept, upon which new information can be added or removed (Pulvermuller, 2005; 2012; 2013; Pulvermuller, Garagnani, & Wennekers, 2014).

Drawing as an intervention can be used to tap into students’ visual concepts, and then tie those concepts to their writing (Arwood, 2011; Doehrmann & Naumer, 2008; Gallese & Lackoff, 2005). In order to help all students understand complex language inherent in the academic language of social studies, teaching of academic language can draw upon brain-based methods (Pulvermuller, 2005; 2012; 2013; Pulvermuller, Garagnani, & Wennekers, 2014). Brain-based interventions in the pre-writing strategies of this study will provide insights into whether students respond positively to this approach. This study proposes to use brain-based interventions that will assist students in tying claims to evidence.
Purpose

The purpose of this study was to investigate whether the use of brain-based writing strategies improved students’ ability to support their claims with evidence, on a state mandated graduation requirement, the classroom-based assessment. This research was designed to evaluate whether using brain-based strategies, as a pre-writing activity in the non-fiction, explanatory writing process, improved writing based on the claims and evidence section of the You and the Economy Classroom-Based Assessment (CBA) Rubric in Washington State’s Essential Academic Learning Requirements (EALRs 2.1.1, 5.2.1, 2.2.1, and 2.4.1). The rubrics associated with these EALRs measure each student’s ability to successfully match his or her claims with evidence in writing. This research was designed to evaluate the working hypothesis that using brain-based strategies as a pre-writing activity in the non-fiction expository writing process would assist students in their completion of two Classroom Based Assessments—Cultural Interactions CBA and the You and the Economy CBA.

Research Overview

This research was guided by two overarching research questions:

1. As brain-based learning strategies are being implemented in real time, what is the nature of the process of using brain-based interventions? In documenting the brain-based interventions, what decision-making factors are considered when designing the unit of instruction?

2. What changes—if any—are demonstrated in student writing performances on a Classroom Based Assessment, when brain-based learning strategies are implemented over the span of the research cycle?
These research questions were answered through a study design involving a cycle of instruction and culminating in an explanatory writing sample. The results of the CBA related to claims and evidence outlined in EALRs 2.2.1 and 5.2.2. Instructional practices to implement brain-based pre-writing strategies will be implemented. Using brain principles to increase visual, auditory, and kinesthetic contact with the concepts presented may improve students’ abilities to make claims and provide proper evidence for those claims, as measured by the Office of the Superintendent of Public Instruction for the State approved *You and the Economy Class Based Assessment* (CBA) Rubric.

The process of my decision making, as well as student writing, was examined to evaluate the effect of brain-based pre-writing strategies, which students use to complete the CBA.

There are four steps in the research cycle: planning, action, reflection, and implications (Schmuck, 2006; Tomal, 2003). The research data cycle begins with planning out the steps in delivering the content, and making interventions to get the participants to complete writing claims based on proper evidence in sample one, *Economy and You* CBA. The next step will be taking the participants through the process of presenting evidence, in the form of a video students will use, to make the claims in their essays. The process of students making claims, and backing them with proper evidence after engaging with the curriculum, will be documented by those students in the assignments or interventions. The specific lesson planning is found in the Procedures Section in Chapter 3. Once their assignments are graded, and students have received my feedback, students will then further refine their thinking. As the
research goes forward, I hope that students will make the connections of matching evidence properly to the claims they make in their writing.

This research was based on literature outlined in chapter 2, past experiences as a classroom teacher, as well as professional development work inside my social studies PLC as well as our specific CWP PLC. The first portion of the data cycle was implementation of lesson plans and objectives that have been set out in the planning phase of the data cycle. Documentation of this experience also includes the interviews and the data, collected from students during the process, as well as assignments, and the two writing samples. The reflection piece will be done once the data are collected and analyzed.

**Useful Definitions**

**Brain–Based** – learning refers to teaching methods, lesson designs, and school programs that are based on the latest scientific research about how the brain learns, including such factors as cognitive development—how students learn differently as they age, grow, and mature socially, emotionally, and cognitively.

**Sociocognitive** – describes integrated cognitive and social properties of systems, processes, functions, models, as well as can indicate the branch of science, engineering or technology, such as socio-cognitive research, socio-cognitive interactions.
**Language Acquisition** – Language acquisition is the process by which humans acquire the capacity to perceive and comprehend language, as well as to produce and use words and sentences to communicate. Language acquisition is one of the quintessential human traits, because non-humans do not communicate by using language.

**Graphic Organizers** – A graphic organizer, also known as a knowledge map, concept map, story map, cognitive organizer, advance organizer, or concept diagram.

**Scaffolding** – is a process through which a teacher adds supports for students in order to enhance learning and aid in the mastery of tasks. The teacher does this by systematically building on students' experiences and knowledge as they are learning new skills.

**Metacognition** – awareness and understanding of one's own thought processes.

**Sensorimotor Stage of Development** – is the first of the four stages Piaget uses to define cognitive development. Piaget designated the first two years of an infant’s life as the sensorimotor stage. During this period, infants are busy discovering relationships between their bodies and the environment.

**Preoperational Stage of Development** – is the second stage in Piaget's theory of cognitive development. This stage begins around age 2 as children start to talk and last
until approximately age 7. During this stage, children begin to engage in symbolic play and learn to manipulate symbols.

**Concrete Stage of Development** – is the third Piaget's theory of cognitive development. This period spans the time of middle childhood and is characterized by the development of logical thought. While kids at this age become more logical about concrete and specific things, they still struggle with abstract ideas.

**Formal/Abstract Stage of Development** – begins at approximately age 12 and lasts into adulthood. During this time, people develop the ability to think about abstract concepts. Skills such as logical thought, deductive reasoning, and systematic planning also emerge during this stage.
Chapter Two: Literature Review

The purpose of this study was to investigate whether the use of brain-based strategies improved students’ abilities to support claims with evidence on a state mandated classroom-based assessment. Specifically, the research will evaluate the working hypothesis that using brain-based, pre-writing activity in the non-fiction expository writing process will assist students to demonstrate logical use of claims and evidence in their typed essays on an Office of the Superintendent of Public Instruction for the State-approved *You and the Economy* CBA.

This chapter starts with a broad overview of writing assessment in high schools and then relates those assessment practices to the design of this study. From there, the literature reviews cover the large-scale topics that are germane to this study in the area of Cognitive Psychology. Brain-based interventions in schools are looked at in-depth, along with linguistics studies that highlight literacy practices. These practices incorporate analysis and the synthesis of teaching students to speak, listen, read, and write, through language learning activities. The last three sections of the literature review are concentrated in valuable studies, which reveal the importance of presenting brain-based materials, along with the role of questioning in the adolescent learning process. This chapter wraps up with a gap in the research into which this study can fit, and inform us about the nature of writing assessments in high schools.

**Nature of Writing Assessment in American High Schools**

The proliferation of student assessment, at all levels of education in the United States of America, has caused each state to enact graduation requirements for their students, which include high stakes assessments attached to State issued high school
diplomas. These State mandated assessments measure the writing and thinking of each student in America, in each academic arena: English, Math, Science, Social Studies, and the Arts. All social studies assessments feature some model of long form essay questions, asking students to make claims, and back them with evidence (Brookhart & Durkin. 2003; Linn, R. L. 2005; National Center for Education Statistics, 2012; Payán, & Nettles, 2008). An examination of the Nation’s Report Card, National Assessment for Educational Progress (NAEP), illustrates that the expectation for our high school graduates is to be proficient in making claims, and providing adequate evidence, in their essay writing (National Center for Education Statistics, 2012). This is measured in every state assessment in America. Also, in every social studies schoolroom, there are written rubrics, published by the state, that are based on citing claims with evidence (National Center for Education Statistics, 2012; National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010a).

According to the Nation’s Report or NAEP, the guiding principles behind their assessments are: All students must have the opportunities and resources to develop the language skills they need in order to pursue their life goals, and to participate fully, as informed, productive, members of society. These standards assume that literacy growth begins before children enter school, as they experience, and experiment, with literacy activities: reading and writing, and associating spoken words with their graphic representations. NAEP advocates the development of curriculum and instruction that makes productive use of the emerging literacy abilities which children bring to school. These standards provide ample room for the innovation and creativity
essential to teaching and learning. They are not prescriptions for particular curriculum or instruction. These standards are interrelated and should be considered as a whole, not as distinct and separable (National Center for Education Statistics, 2012).

In 2008, in order to measure Adequate Yearly Progress (AYP), as outlined in the now superseded federal No Child Left Behind Act, the Office of Superintendent for Public Instruction for the State of Washington developed the Classroom Based Assessments (CBA), which all teachers in the State are required to use in each social studies class. Each CBA was developed with Grade Level Expectations (GLEs) in mind, and You and the Economy CBA is no different, and was chosen because it was developed for CWP senior students. Because this is the nature of assessment in Social Studies Education, it is important to discover the best ways in which to allow all students access to the formal/abstract task of completing a writing assignment, in this case a CBA. Evaluating students’ writing based on state assessments, on a national scale as well as brain-based education strategies, are relatively new studies in education, and require a close look that this study will provide.

**Research Design and Instructional Interventions**

Schmuck (2006) and Tomal (2003) discuss four steps in the research cycle: planning, action, reflection, and implications. The research data cycle begins with a plan to deliver the content based on the learners present, and using interventions, through which participants can complete writing claims based on proper evidence; in sample one, You and the Economy CBA. Research principles were used to identify the parameters of this experiment. Because many of the principles of educational research are fundamental to modern education, as well as all that is expected of teachers in the
classroom, this model provided the structure that is evident in so many of the studies cited in this chapter. While many models of research from which to choose are available, Schmuck and Tomal’s approaches were well suited to this study because of the use of classroom interventions as the basis for the study.

**Cultural Neuroscience Helps to Explain How Adolescents Learn**

Culture influences how language functions in the brain, the most complex organ in the body, as well as ways in which, and how, humans interact with one another, (Kim & Sasaki, 2013). As learners come closer to formal thought, which includes making claims, and providing evidence to make claims, different areas of the brain become activated (Baars & Gage, 2010). The areas associated with connections and communications are found in the prefrontal cortex. The motor cortex houses planning and executing motor movements, as well as empathy and imitation (Baars & Gage, 2010). The authors continue to describe that Broca’s area sits toward the back of frontal lobe in the brain, on the right side, which allows for language production. And, interacting language production with writing, or typing, is a valuable whole-body learning experience. They conclude that, in order to create maximum meaning, listening, and subsequently, writing what has been heard creates a higher retention.

Another, more inclusive, way to achieve this integration would be to think, write, and use pair and share strategies. The more access for information to be processed by the body, the more change the individual experiences, and through which, the individual can then make sense of the perceptual patterns that are formed into concepts through language (Baars & Gage, 2010).
Learning is a neurobiological function that is achieved from the process of acquiring language, and accordingly, by using discourse to engage among humans visually, aurally, and kinesthetically (Baars & Gage, 2010). Learning, or neuroplasticity, is the long-term potentiation for neural cells to connect and fire in sync, for quick retrieval by the thinker (Hebb, 2002). The more quickly we retrieve information from long term memory, and transfer it to working memory, the more immediately we can complete daily tasks. As we grow older, myelinated paths turn into grey matter, or structures moving massive amounts of data from one relay station to another, in order to quickly retrieve the thoughts we have repeated over and over, again and again, through years of retrieving data (Baars & Gage, 2010; Pulvermuller, 2005). When new information is synthesized with old, one refines the concepts, and thus, adds onto and expands ones understanding of a concept, of which one may already have some knowledge (Piaget, 1959). In order to refine a concept, the thinker has to retrieve the existing form of the idea, retell it, and make new connections to the old, in order to solidify the story. Then they must remember it, and save it again, much like when you save, and resave, a word processing document. This is how the brain consolidates, retrieves, and produces new concepts (Baars & Gage, 2010).

As teachers, developing neurological language connections for students in our classrooms can help inform us as to the learning in which our students are engaged (Kutas & Federmeier, 2000). If learning or neuroplasticity has occurred in this classroom, how will we know?

As argued by Albers et al. (2008), Brewer et al. (2012), the task of seeking to develop methods through which students can discover a genuine interest in topics that
stimulate them to learn for their own sense of achievement, must be foremost on the minds of educators. Integrating students into the process of learning allows for multimodal engagement to occur; consequently, the artifacts from neuroplasticity will represent students' thinking, and will manifest in their writing and speech (Kutas & Federmeier, 2000). The interpretation of what adolescents need, and determining when, is difficult. Therefore, when educators intervene, scaffold, or differentiate, they must have appropriate brain-based, study-backed information.

The language used by students to explain thought, internally and externally, in both written and spoken form, can further enhance the individual’s ability to think, and display that thinking in writing, speaking, and action, in this world (Bonesronning, 2004; Fugelsang & Dunbar, 2005; Tommerdahl, 2010). Understanding the learning process as an artifact of the neurobiological system is important, because neurobiological brain structures form in individual ways (Lenneberg, 1970). Differentiation, or understanding each learner, is a key to scaffolding, and delivering valuable learning experiences. Adolescents can then engage in brain-stimulating activities designed to allow for learning of new content. They will refine their understanding of the world through those experiences, and can also learn from those around them (Vygotsky, 1978).

**Linguists Explain How Adolescents Learn Language**

For decades, literacy researchers have studied the role that visual images, drawings, and audiovisuals have had on children’s abilities to acquire language from reading (Cerkez, 2014). Adolescents make sense of language through writing, speaking, and interacting with others in the social setting. Children learn how to
functionally get along in society through their ability to communicate with others (Piaget, 1959; Vygotsky, 1978; Worf, 1940). Writing to multi-modes of discourse, such as documentaries, real world experiences documented by the media, or by reporters themselves, are phenomena increasingly encountered in our culture (Vitulli & Santoli, 2013; Vorvilas, 2014; Wysocki, 2008). Best literacy practices that engage adolescents are based largely on and in response to, a barrage of visual stimuli, in the form of videos or information presented on handheld devices, and which have the ability to harmonize in order to elicit a visual, auditory, and tactile response all at once (Baars & Gage, 2010). Added to this is interpersonal meaning, which is deepened with multiple access points to the learner (Cerkez, 2014).

In adolescent classrooms, incorporating visual interpretations into the act of writing, through showing newscasts, investigative reporting, movies, documentaries, still pictures, or other visual artifacts, informs the writing process positively (Castera et al., 2012). The authors studied Estonian secondary students, and found that visual literacy could be increased through interactive lessons over the internet. Unfortunately, there was no writing assignment linked to this study. Other empirical studies emanate from countries outside the United States, those such as Rowsell and Decoste’s 2012 study of a Toronto Secondary School, in which they investigated students’ writing through different materials using music videos. The study sought to engage more of the senses, in order to find out if the writing-to-video images enhanced the students’ understanding of the meaning behind the audiovisuals. This study did not engage in dissection of writing for language function, or use a rubric to measure pre-and-post language samples to any writing prompt. This particular study was
inconclusive as to whether or not the students' writing about the video was enhanced, but it was conclusive that those who wrote to the music video displayed a greater contextual understanding of the lyrics, than those that did not.

Another empirical study in the secondary field of examining visuals, and relating them directly to writing, was done by Rowsell and Kendrick (2013), who studied the ways in which New Jersey secondary students, specifically adolescent males, utilized various visuals for writing. In this case study, they found that when adolescents chose their own pictures to write about, the practice greatly promoted student agency. Agency is the capacity of an actor to act in a given environment. This model created opportunities for critiques of society, and brought out discussions regarding the audience for whom they were writing, as well as their purposes for writing (Rowsell & Kendrick, 2013). The backdrop of information that students provided, regarding their explanatory writings, determined these findings. There were prompts to the writing task, but no rubric or pretest/posttest was used to compare language ability. The value of the study showed that students become positively engaged, as demonstrated by the rich discussions subsequently produced and reported in this study. Along with those rich discussions, this inquiry suggests that pictures had a positive impact in informing the final written product, which proved to be valuable to the students’ understanding of the material presented.

Cognitive Psychology that includes these studies speaks of the neurobiological process of learning through language acquisition. Any time the learner can increase the perceptual patterns of the visual, auditory, and motor systems, the more ingrained learning becomes in the memory system (Bars & Gage, 2010). The perceptual patterns
develop into concepts that fire neurons in the cortex (or outer reaches of the cortex) and frontal lobe, which lodge in our higher order thinking and memory regions in our brain. The authors go on to describe how these perceptual patterns then form concepts. As the adolescent learner’s brain prunes the connections in the late teens and early twenties, and is wired together, decisions, which take many factors into account, take place more frequently than when the learner was a teen. The frontal lobe, where executive decisions about actions are connected to consequences, wires to the central nervous systems in the brain stem, and comes online with the rest of the brain during this time in late adolescence. This activity then initiates the shift into early adulthood, according to Bars and Gage. Then, and only then, do learners experience what is called rational thought. Subsequently, rational thought happens when more connections to the language centers in the brain, as well as to the frontal lobe, appear. The frontal lobe holds executive functions, so the brain can then make decisions, rather than simply reacting as a brain stem, or as the limbic system, which spurs fight or flight responses (Bars & Gage, 2010).

**Cognitive Psychologists Explains Adolescent Learning**

Piaget’s (1959) theory on the cognitive developmental stages of children gives a basis from which to begin assessing adolescent thought or language, both spoken and written, through language function, or the ability to use language to get what you need from your culture, in order to survive and thrive (Hockett, 1960). Vygotsky’s (1978) theories about sociocultural interaction, combined with Hegel (2010) and Marx's (1906) sociocultural dialectic models of cultural learning, provide a theoretical foundation for studying the cultural context of language use (Hockett, 1960). Critics of
Piaget suggest that his empirical process was based on the belief that biological mechanisms, which function internally in the individual, comprise the process of learning, and are steeped in steps from sensorimotor, to preoperational, to concrete, to formal, each having defined thought implications for the individual (Vygotsky 1978).

The explicit theory is that learners must progress in a step-by-step manner from one to the other. Many studies have replicated Piaget’s theories. The research of both Liu, Tsao & Kuhl (2009), and Naylor & Keogh (2000) suggests that constructivist designers of education, such as Piaget, would assert that teachers must have a developed understanding of the theories in order to guide their curriculum decisions in the classroom, additionally, that these teachers must understand the biological drive which Piaget researched so aptly, and which, describes the steps of child development. For the learner, the place amongst peers and adults is founded on the ability to communicate, in order to get needs met in each setting. Training teachers in this theory is a difficult task (Naylor & Keogh 1999), and its implementation takes a deep understanding of such theory.

Piaget’s biological and psychodynamic approach combined with Vygotsky’s sociocultural and humanistic approach, are the basis for the social process of language acquisition, as the primary source of learning for the individual. For the learner, their place amongst their peers and adults is founded on the ability to communicate, in order to get needs met.

Constructivist such as Piaget and Vygotsky, have been criticized by authors such as Liu and Mathews, (2005) as well as Engestrom, (1996) for being too particular about how individual child development fits into prescribed steps of learning. These
authors suggest that this theory only explains childhood from a particular perspective that of western-based thought (Cole & Wertsch, 1996). Further criticisms notice the possible influence of a western cognitive culture that separates mind from body in the Cartesian method. This method seeks to create a societal belief to structure education of the person, from the people (Foucault, 1965). A monist theory of construction of mind, body, and brain, all, in fact, being one with the environment, rather than divorced from it, might explain the limitations of thought inherent in a dualistic culture, which separates mind/brain and body (Rockwell, 2005). Again, even amongst detractors, a more thorough body of authors bases its theories that Piaget made both a living and a following, defining and challenging hypotheses. The findings of Piaget reveal that laws of conservation in children are not the same as in adults. Textbooks are a testament to Piaget, as he is cited and revered throughout the Western world as a renowned thinker.

According to Jones and Brader-Araje (2002), constructivism’s success may be due in part to the frustrations that educators experienced with behaviorist educational practices. Beginning in the 1960s, behaviorism swept from the arena of psychology into education, with an air of authority that was startling. Schooling became structured around the premise that if teachers provided the correct stimuli, then students would not only learn, but their learning could be measured through observations of student behaviors. The behaviorist movement led to a long series of strategies for schools, such as management by objective, outcome-based education, and teacher performance evaluation systems. Behaviorism in schools placed the responsibility for learning directly on the shoulders of teachers. Teachers were led to believe that if learning was
not occurring, then it was their responsibility to restructure the environment, determine the most appropriate reinforcement to promote the desired student behavior, or provide a negative reinforcement to extinguish unwanted behaviors. In the field of Psychology, there are seven perspectives for looking at the human psychodynamic, cognitive, behaviorist, humanistic, biological, socio-cultural, and evolutionary (Myers, 2010). While brain-based educational strategies take into account some aspects of operant conditioning in the form of positive reinforcement or feedback, it also covers the humanist, biological, socio-cultural, and evolutionary perspectives of humans interacting with, and in, their environments.

**Piaget’s Biological Developmental Model.** Piaget (1959) explicitly defines the concrete stage of development, in which children ages 7-11, begin to start solving problems using the logic of inductive reasoning. While the age ranges of this study are above this particular age level, many adolescents exhibit both thinking and writing behaviors at this concrete level (Bruner, 1990; Piaget, 1959; Vygotsky, 1978). Even though this is a level of pre-adolescence, many of our adolescent students slip into this realm while they are also taking on characteristics of the formal stage, the step beyond concrete, in child development (Bruner, 1997; Gordon, 2009; Huitt & Hummel, 2003). Using observations of everyday life to draw inferences about how this world operates can be seen in the work of children in the concrete stage (DeVries, 2000; Gordon, 2009; Moshman, 1982). Children in this stage are stuck in concrete problem solving, only able to solve immediate problems, without the ability to take other points of view, and consider other perspectives; children in the concrete stage cannot solve hypothetical problems (Piaget, 1959). Vygotsky (1978) also extolls the virtues of
emerging adolescent thought as moving towards a greater conceptual understanding of abstract thought, while more conversations in adolescent circles revolve around more abstract forms of knowledge (Gordon, 2009; Vianna & Stetsenko, 2008)

All learners are introduced to new topics in the preoperational stage, or me-stage. Piaget (1959) describes the emergence from this stage into the start of concrete, as such “It seems pretty certain, therefore, that the capacity for arranging a story or an explanation in a definite order is acquired some time between the ages of 7 and 8” (p. 110)

Furthermore, Piaget wrote,

The reasons, therefore, why genuine argument, like collaboration in abstract thought, appears only after the age of 7 or 7½ in the development of the child, are of a very fundamental order. Does the absence of verbal forms expressing logical relations prevent genuine argument from manifesting itself, or does the absence of the desire to argue and collaborate explain the late appearance of these verbal forms? If we admit that thought in the child depends upon his interests and activities rather than vice versa, then the absence of the desire to argue and collaborate is obviously the initial factor. This is why we have begun our study of child logic with a study of the forms of conversation, and of the functions of language. But there is, as a matter of fact, perpetual interaction between these two factors of evolution. (p. 73)

Collaboration and argument between that which the learner understands the structure of the function to be, and what another conversant understands it to be, interweaves with the reality of the history of both participants. Each participant in the
conversation with the child, near the end of preoperational, and into the concrete, expands the child’s understanding of the world by speaking with the child, and informing him of the structure and its function.

A pattern develops over time and repetition; multiple structures of the function are more clearly understood by the child, as the child can name things according to schema, and negatively or positively assign attributes and definitions for the concept. As the child’s experiences, and stories of others, match verifiable scientific accounts, they add to the child’s already held structures that support the concepts’ function.

Vygotsky’s ideas of the zig between concrete, and the zag of formal thinking might accompany an adolescent’s frame-of-mind. The zig between a preoperational 5 year old, and the zag of her concrete categorization of the colors of the rainbow, would be analogous to each other. As children mature, they make zig zag-like progress in understanding of the function of concepts. Much like the play between inner speech and external speech, children understand their universe by observing structures, and then connecting them to what they envision the function to be. In reality, they are continually in search of someone to help guide them to the formal stage, where they recognize that maximum displacement of taking thought, and making it travel, then consequently telling others about those travels. The structures add to the function of the whole; the concept itself has gone through profound changes and reformation to include the previously held erroneous assumptions, as well as the correct ones, to form the concept function.

Piaget was a constructionist who believed that children go through developmental stages marked by distinct, calculated, and measurable methods, and which are
chartable within western civilization. This perspective influenced his sense of child development through the biological and social aspects of learning.

Vygotsky (1978) describes this area of childhood development as the border between the ability to use language to prescribe thought, and the beginning of self-restraint, as defined more by the influence of what those in the learners' peer group might be thinking. Both Vygotsky and Piaget came to realize that there are extra constraints upon the child, but Vygotsky seems to be drawn more to how language is adapted in the arena of peers, as well as by teachers and, or, parents (Fox & Riconscente, 2008; Tudge & Winterhoff, 1993; Van Geert, 2000). For Vygostsky, language interplay, in all contexts, depends on the usage of phrases, word choice, and body position. This interplay only can be learned through interpersonal contact and communicating with others; Piaget theorizes that the most important interplay is the individual world that each communicator is presenting. Vygotsky looks at the language of presentation, and how each person then uptakes that information, and transforms it, or not, into the individual’s consciousness for long term, or the biological process of learning (Gordon, 2009; Vianna & Stetsenko, 2004).

According to Vygotsky (1978) the march towards adulthood, for children, is to keep up with the thoughts of peers by creating individual meaning from their interactions with one another. When adolescents refine this skill enough, they align private speech and public speech to attain private goals, which may or may not be revealed. This activity helps create the adult voice, and the transactional process of being able to use self-talk to motivate oneself to plan for future outcomes, and to make those outcomes a reality (Bruner, 1990; Jones & Brader-Araje, 2002; Vygotsky,
Vygotsky proposes that children, into adolescence and beyond, increasingly engage in three forms of speech: external (language and stories we share with others), egocentric (the child’s own personal consciousness and will), and inner (the ongoing monologue that guides us through our learning processes) (Bruner, 1990; Jones & Brader-Araje, 2002; Vygotsky, 1978). This corresponds to Piaget’s ideas that self-regulation allows for metacognition, wherein adolescents and adults reason through thought processes, and monitor them using inner language (Bruner, 1990; Jones & Brader-Araje, 2002; Vygotsky, 1978).

Processes of planning, allocating resources to get the job done, monitoring, awareness of task performance, comprehension, evaluating and appraising the final product of a task, as well as the efficiency of the task, were performed, and lastly, giving re-evaluation feedback to one’s progress in life, all begin at this formal/abstract stage, and advance into adulthood (Piaget, 1959; Fox & Riconscente, 2008; Vygotsky, 1978). As adolescent brains refine and mature, they start to resemble adult brains. Metacognition, thinking about thinking, and abstract/formal phenomenon can be used to better understand the world (Piaget, 1959). Once language and knowledge reflect those of the other adults around them, and they can respond in kind with correspondent language and action, then we ask; can children become adults, and can concrete thinkers move into a formal/abstract manner of thinking about the world, and place in the world (Bruner, 1997; Fox & Riconscente, 2008; Vygotsky, 1978).

The split between Piaget and Vygotsky occurs because Piaget suggests that the individual relies more on an adult than on a peer (Glassman, 1994; Tudge, 1992; Vianna & Stetsenko, 2006). Vygotsky theorizes that for the emerging adult, more
acceptance in the group replaces the bond with adults (Tudge, 1992; Vianna & Stetsenko, 2006). As adulthood is achieved, the interaction in social scenarios with peers, and then refining them, and checking with adults, has always been the model for processing in children; they just need an adult to provide them with those opportunities to learn (Piaget, 1959; Fox & Riconscente, 2008; Vygotsky, 1978).

Adolescent thinking can tend to be black and white, right and wrong, lacking understanding that comes with age and experience, and the ability to see other points of view (Baars & Gage, 2010). As metacognition comes on board, the adolescent learner comes to understand points of view, and that they, as well as others, have views about what is “wrong” or “right” with the world. Understanding Vygotsky’s (1978) work at this point is crucial. Vygotsky’s (1978) was a pioneer in observing how children in groups interacted, and practiced language with each another, in order to learn behaviors appropriate to their given social settings. What is appropriate for adults to speak to one another about may not be appropriate for children to speak to other children about, or children to adults. We can derive from Vygotsky’s (1978) work that language/learning, through socialization, happens in every cultural scenario with social constraints, and is up to individuals engaged in the interaction. Learning what is appropriate in language experimentation with peers allows us to understand what is appropriate within society at large. Interactive dialogue inside social studies classrooms is important to Vygotsky’s theory.

Furthermore, Vygotsky’s Zone of Proximal Development (ZPD) describes socialization, as directed by a professional teacher, can be tailored to a student’s understanding of the world. For example, if students find themselves in a situation
with others of greater ability, learning from other’s successes or failures creates the model of a path that will guide the student to the destination ahead. As the plan is being carried out, the successful learner makes plan revisions to meet conditions, and assesses the results on the path to the outcome, and receives assistance from one who has already completed this task. Like the struggle of Piaget’s (1959) cognitive dissonance, Vygotsky’s (1978) ZPD is just out of reach of the students’ comfort zone, so there is a problem to work out in order to increase students’ problem-solving abilities, which is the highest form of intelligence, according to Vygotsky (1978). The term scaffolding was coined by Bruner (1990) to mean the purposeful guidance by a teacher who knows the material, and how to access the learning aspects of the given material.

Situated learning, an important concept that ties Vygotsky and Piaget together, and brings out the constructivist type of Community of Practice model in Lave and Wenger, (1991) also ties into teaching adolescents how to think in a structured environment. In a Community of Practice, the depth at which each member connects depends on the prior knowledge, and the willingness of each individual member to act (Lave and Wenger, 1991). Communities of practice allow each member to receive a different body of knowledge, depending on what each contributes (Lave and Wenger, 1991). In Lave and Wenger, and creating communities of practice based on habits of mind by Costa (1991), information about language processing fits with actively engaging adolescents in language-rich environments, through which those individuals can make personal connections in order to connect the material to their world view (Piaget, 1959).
**Acquiring Language is a Learning Process.** Language acquisition, for secondary students, revolves around their peer groups inside the classroom, as well as their outside peer groups, to practice, inform, and refine their thinking on any given subject (Adolphs, 2009). These interactions inform secondary students about the world, and allow for a feeling of communal acceptance as they test their language ability, and the thought behind this ability, with members of the community at large. Being able to function in a secondary school setting instructs students how to engage with this world (Robinson, 2010). Identity, as a result of language acquisition, motivates adolescents to move towards the person they would like to become, as they move through culture (Foucault, 1965; Goffman, 1959). Recognizing one’s place amongst the group is a powerful indicator of fulfillment as a human being (Vygotsky, 1978).

Every individual has a biological response to language, and language for each person indicates levels of variety that are equal to the individuals that speak any given language (Piaget, 1959). This means we all have our own limitations of understanding in any given moment, depending on what we do and do not know (Vygotsky, 1978). When engaging in language with others, our language capacity expands and neuro-semantic pathways are established. Learning or neuroplasticity occurs, informing the speaker and listener in any given setting that information has transpired (Lenneberg, 1970; Pulvermuller, 1996). Interchanging with others in language informs our thinking; in fact, it is our artifact of learning (Dore, 1975; Pulvermueller, 1996; Smith, 1978, Witelson, 1987). Expanded language functions, according to Hockett (1960) allow learners to think critically and problem-solve, speak to others, and communicate
in writing. Hockett explains that without expanded language functions such as displacement, semanticity, flexibility, redundancy, and productivity, learners cannot move past the pre-operational level of the here and now.

**Language Structure and Function.** Hockett, (1960) describes that when students are successful in talking about, and writing to, standardized assessments, their ideas show displacement, semanticity, flexibility, redundancy, and productivity.

Linguists refer to displacement, or, the understanding that ideas are separate from the physical existence of a person, which allows communication with others, over time and space. Semanticity in linguistics refers to the overlapping of meaning, created from experiences, layered with language, and naming concepts, which offer more complex meanings to be shared about higher order thoughts (Hockett, 1960). Flexibility is the linguistic ability to communicate with others about an array of concepts that can be utilized in a variety of different settings and ways (Deak, 2004). With productivity, concepts mean similar ideas in spoken, or written form, and these concepts are understood through drawing, numeracy, writing, or speaking (Hockett, 1960). Then with redundancy, concepts increase in learning to a point where they can synthesize with others, and form specific and efficient messages to others from their synthesizing of multiple concepts (Hockett, 1960).

When these building blocks of linguistic study come together, we, as listeners, understand the intent of the thinking, writing, and language of the learner, in a way that allows us to understand the message, which that learner is attempting to convey (Hockett, 1960). When these linguistic principles are not in place, there is a potential for arrested development in the brain, which manifests itself as problems in the
thinking and writing of our students (Hockett, 1960). With the ability to move to another level, say from concrete to formal, sociolinguistic language levels must then include thinking aspects, such as the above-mentioned interpretations laid out by Piaget (1959), and refined by Vygotsky (1978) and Bruner (1990).

These linguistic examples of displacement, semanticity, flexibility, redundancy, and productivity are important in order for learners to convey meaning in the English language. Studying language samples specifically focused on prepositions, (intended meaning) and combining three of which, produces formal basis for thought. Adolescents can use language indicators of time (temporal)—marking prepositions such as before, after, during, and, so, while, then—to connect three ideas, according to Arwood (2011). The Theoretical basis underlying this thought is a neuro-social theory known as Pragmaticism (Arwood, 2011). This theory defines learning as a socio-cognitive process, unique to the individual, wherein language represents learning, and is a dynamic process of interaction between the neurological composition of humans, and the consequences experienced within the social environment. As new information is integrated and overlapped with old information, concepts, as well as the language supporting those concepts, are refined. How a person establishes shared meaning provides information about that person’s conceptual development, and level of semantic functioning.

**Typical Language Functioning.** Piaget (1959) suggests that children over the age of eight use language to talk about ideas that are not seen, such as concepts of *responsibility* or a *typical day*. These concepts are removed or displaced from what can be seen by a speaker. When the speaker wishes to talk about these displaced
concepts, then elements of time are used. This ability to talk about displaced objects using temporal elements requires a linguistic level of semantic development, referred to by Piaget as the formal-operational level of cognition. The linguistic language user is able to temporally connect three ideas as one, which refers back to previous ideas; this occurs as well when verb tenses function to represent temporal relationships, and when time markers connect ideas.

**Atypical Language Functioning.** Empirical studies show that language acquisition is based on conceptual understanding of what the learners have experienced, and can communicate with others, in order to inform them of their world (Gallese & Lakoff, 2005; Morgan et al., 2009; Pulvermueller, 2005). The making of meaning is done through communicating and refining our concepts, based on the input we get from sight, sound, and feel, and then added to our language, and lastly, shared with others in order to inform us of our world (Gallese & Lakoff, 2005; Mohr, et al., 1996; Pulvermueller, 2012). Based on our language understanding, we can have these concepts in a pre-operational, concrete, or formal level of thinking which informs us of our world as our brains move from adolescent, or concrete understanding of the world, to a more formal understanding of adulthood (Piaget, 1959).

As neurobiological principles are linked to language, the study of language structure may provide an understanding of the producer’s mastery of the language, and therefore, thinking (Lenneberg, 1970). Looking at the cognition and purpose of the language, or the function of language, is greater than the surface structure, and can be found in adolescent classrooms that use reading, writing, and drawing, in order to access learners’ visual spatial memory, as well as their temporal language when they
talk, read, and write about the subject in a classroom setting (Arwood, 2011; Baars & Gage, 2010; Vreko, 2010; Smith, 1978).

According to Arwood (2011) analyzing the deep structure of language, such as listening to how adolescent speakers verbalize, and how adolescent writers express themselves, all while dealing with the temporal nature of the English language, can provide valuable information about the thinking behind the writing of the participants (Hocket, 1960; Whorf, 1940). Ultimately, we recognize that all beings, through their language, access the world outside their bodies, as well as inside their brains, and the language they speak defines the understanding that specific being will have of the world (Whorf, 1940). The learners’ language function is how adolescents construct their identities and is based on their understanding of the world around them (Goffman, 1959; Mead, 2009; Whorf, 1940).

**Brain-Based Interventions in K-12 Education**

Cartooning is the visual expression by means of students' paper drawings, in order to recreate images that students have stored in their visual memories. These drawings access previously stored information, which adds new information to existing structures in the neural pathways of the brain. Sallis, Rule, and Jennings & Da (2009) found that 4th graders working in small groups identifying rocks and other fossils could create visual storybooks, and humorous educational cartoons. A study by Duffy & Burton (2000) developed a theory, which found cartoons to be deeply relatable in conveying messages to children, through the monitoring of Joe Camel ads from the old cigarette ad days. This study showed that more than 500 Chicago area children identified with a cartoon advertisement, more so than by other examples. While the
students did not generate the cartoons in both studies, the studies did show the relevance, and the meaning, that cartoons have for children, and how the practice can be modified to best scaffold learners.

A similar approach to cartoons, as a comic or humorous approach to education, comes from the studies of Song, Heo, Krumenaker, and Tippins (2008), and McCartney and Samsonov (2013), and had similar findings to the previously mentioned article. The difference between the Song, Heo, Krumenaker, and Tippins (2008), and the Sallis, Rule, and Jennings (2009) studies, was that students created the actual drawings, rather than presenting them in story format.

In another constructivist-based study, Spevak, (2008) used the cartooning activity, along with some prompts and scaffolding by the teacher, as aids to complete a project. The author found that abstract concepts were conveyed through cartooning to illustrate Newton’s laws of motion. By using Piagetian methods of moving 14-15-year-old-students from concrete to formal understanding, this study featured students using an eight-panel format of cartooning. The author conveys that students openly worry about their drawing abilities, and need supportive communication to understand why those particular abilities were not paramount. Ultimately, Spevak found, “cartooning was an enjoyable way for students to have a creative voice during their learning, and a subsequent assessment of their cognition and metacognition of the laws of motion” (p. 46).

One study, which bridges the gap between video literacy and cartooning, is a Perales-Palacios & Vilchez-Gonzales (2002) study which used students out of class, and popular TV watching (Pokemon and Simpsons), in order to identify specific
lessons on scientific concepts. The concepts were presented in these cartoons to enliven student understanding of concepts, then explored in class so as to scaffold the students’ understanding of academic language. The study concluded that the misconceptions of the students matched those of the cartoon, which allowed for good classroom-based interactions, and encouraged all learners to participate at a higher rate than they might, had they not been assigned to watch cartoons outside of class. All these studies are done in science classes; they both cite and follow the Vygotsky method of close student-to-student collaboration, with appropriate scaffolding techniques for their students. A universal finding is that more students than usual were engaged in the classroom activities, and there were preoperational sparks, from the drawings, that allowed for this to happen.

Two other cartoon-based studies were related to social studies. One examined a cartooning approach to exploring the Greek debt crisis in a primary art classroom, (Christopoulou, 2013) and the other used cartooning to study the War of 1812 (Fuller & Pribble, 1982). Christopoulou (2013) found that through sketching political cartoons “students located, identified, and labeled the multiple facets of the Greek crisis in a way that was meaningful to them” (p. 44). Creating personal meaning is done at the preoperational level, and this is evidence of Piaget influence (1959). Student cartooning in this study focused on the lived experiences of 10-12-year-old Athenian school children. Students were facilitated, through explorations with the teacher, to discuss formal concepts such as poverty, unemployment, strikes, protests, authority, and violence, as social impacts of the Greek Debt crisis.
Fuller and Pribble (1982), like Christopoulou (2013), focused on cartooning as a learned student activity that can increase participation, as well as deepen understanding of concepts. The 14 year-olds in this study made drawings, which were preoperational to concrete in nature, and described the effects of the War of 1812 in breaking the Union. There were also drawings of an iron horse taking the place of the animal horse, as the primary mode of transportation in the emerging US west. None of these studies, however, take into account brain-based instructional strategies.

Keogh and Naylor (1999) used Concept Cartoons as a backbone of their studies. The authors explain that over twenty years, Concept Cartoons have taken on these significant features:

1. They are based on everyday situations that do not appear to be scientific, so students lacking in confidence are less likely to be intimidated by the science, and more likely to engage with them. These everyday situations appear to be effective across geographical and cultural boundaries, enabling Concept Cartoons to be used successfully in a wide range of countries.

2. They present alternative viewpoints on the situation, including the scientifically acceptable viewpoint(s). Most of the Concept Cartoons embed scientific ideas in everyday contexts, and the contextual features can influence how the problem is interpreted, so that in many cases there can be more than one scientifically acceptable alternative. This presents an additional level of challenge to learners, especially to high-achieving students.
3. They have a blank speech bubble, to give a clear statement that there may be more ideas, not yet included in the dialogue, so that learners are encouraged to explore alternative ideas.

4. The background text is written in students’ language, so learners can use it independently, if the teacher feels that this is appropriate. This extends the range of ways in which teachers can choose to use Concept Cartoons in their classrooms.

5. All the alternative viewpoints have equal status. When the teacher presents a set of alternative viewpoints in a Concept Cartoon, all of these viewpoints are seen as legitimate. (p. 440-42)

This gives less confident students support in voicing what they think, because someone else has already articulated their ideas. If their ideas are incorrect, then they can blame the Concept Cartoon character. Keogh and Naylor’s early research indicated the need to minimize any contextual clues, such as those given by facial expressions or wording of statements, so that students cannot use these in an attempt to work out their answers.

The speech bubbles include common misconceptions, so these can be recognized and addressed directly in the lesson. Some teachers are concerned that raising misconceptions may make students more likely to believe these, but research indicates that this does not happen in practice, and that Concept Cartoons can be a very effective way to challenge misconceptions. Concept Cartoons present plausible alternatives that are based on research evidence about students’ ideas, at different stages of their development.
Keogh and Naylor’s (2000) study is constructivist in nature. Like many constructivist classrooms, the authors found that putting the theory into practice can be difficult. While the cartooning is appropriate in the constructivist manner, it does not provide evidence of student interest, which intrinsically motivates students to attempt, and complete, work.

One study suggests that students cartooning their visual thoughts integrated the acoustic information they heard on a subject, with the visuals they already have constructed in their heads (Kutas & Federmeier, 2000). According to Merzenich, (1981) humans use their hands to write or type their thoughts as language, to express their thinking to others, and this practice informs the readers' thinking about the topic. Also, the hand-moving creates meaning through assigning that motion, as the brain cognitively recognizes this process learning, or the habituated motion of learning, connecting long term information from one network of brain cells to another (Hebb, 2002). This process allows the brain to interpret information through all three modes: visual, acoustic, and feeling (Merzenich, Nelson & Kaas, 1981). The more information we collect from all our senses, the more likely our brains are to process that material coming in, connect it to information that is already there, analysis, and then synthesize this new information with the old, thereby forming new connections and creating long term potentiation, or the basis for learning. Because humans store pictures in the visual cortex, that brain area which stores long term information, drawing visuals as concepts allows adolescents to see, and feel, how the understanding of different concepts match, to inform schema and meta-cognition, and students recognize the information they are synthesizing in visual form (Flavell, 1979; Mackenzie & Veresov 2013, 2013; Piaget,
Once students write to those brain-based assignments in the pre-writing phase, the writing process is refined and improved; as the multiple modes of sensory input, via the motor, visual, and acoustic systems in the brain, inform one another, understanding of the concept deepens, and allows the learner to form a concrete or formal understanding of the topic (Piaget, 1959).

**Studying Visually Prompted Writing.** Many of the studies done with college age students, either in pre-service teacher training programs, or other visual literacy studies that examined ways in which young adults grasped visual representations as a method to refine the writing process, discovered that images, and the processing of them, was complicated by the massive amount of images with which young people are bombarded as they mature (Brumberger, 2011). In fact, Eitel et al, (2013) suggest that before writing, if students are shown an image of what is to be written about, they have a better spatial idea of the concept, than if they read from a text about that concept. A meta-analysis study done by Eitel and Scheiter (2015), which looked at the sequencing of text and pictures for learning outcomes, concluded that the relative complexity of information conveyed by the picture, as well as the text, determines the most likely medium to be processed first. The review also suggests that the sequencing of the text and pictures did not matter as much as other factors, for instance, type of assessed knowledge, and relative complexity of text and picture.

In a case study which engaged a First Nation community to discuss visuals, students reported a feeling of validation, not previously attained when writing and discussing feelings of humanity, as well as ties to a larger, non-indigenous culture, which did not include the use of visuals (Montero et al., 2013). Humans are drawn to
information presented at their pre-operational level, *what does it have to do with me* (Piaget, 1959). From there, acquiring concepts is a matter of assimilation or accommodation (Piaget, 1959). We either assimilate the new information with the old, including minor or major cognitive dissonance to add semantic meaning based on our world understanding, or we assimilate that new information into our world view in order to better understand it, or we simply do not make the new learning connection, or create neuroplasticity (Piaget, 1959). When we incorporate information from the outside world, to the inside world of our brains, we must adjust the concept, in order to accommodate the new information, which refines our schema (Piaget, 1959). If we assimilate it, we can simplify whatever new information we have gathered, without changing the underlying meaning residing within the schematic understanding of the concept we previously held (Piaget, 1959).

Part of being visually literate is to understand the culture in which one lives: one that involves meta-cognition, a formal operation. Understanding the various mediums used by students to acquire information, frames the story, in terms whereby the medium presents the information that is being broadcast (Piaget, 1959; Pulvermüller, 2012; Vygotsky, 1978). The Zenkov et al., (2013) study examined three different classrooms in a mid-western city, which were dominated by diverse neighborhoods. This culturally relevant, pedagogy-designed study examined the visual images that adolescents captured with their own cameras (Zenkov, 2013). Students were given cameras, and were encouraged to take photos that illustrated such concepts indicated by this prompt: “What is the purpose of school?” While this study included many images and themes from student data, the writing that teachers assigned to students
was not analyzed by a pre and post test study, and no language rubric was used to evaluate the student’s limited written artifacts (Zenkov, 2013). This study highlights the importance of attaching images to writing, and how important visuals are in the writing process.

Many studies have dealt with incorporating visuals in the development of writing and language acquisition for students at the pre-operational level K-3 (Franco & Unrath, 2015; Mackenzie, 2011; Prior, Wilson & Matinez, 2012). All the studies have shown consistent gains in academic growth, when incorporating images into the language acquisition in the form of student drawings (Barbot et al., 2013; Dyson, 1988, Einarsdottir, Dockett & Perry, 2009). Specifically, in the Barbot et al. (2013) study, there was a pre and post-test based on observed student activity, but not on language samples. The results from these studies suggest that drawing helps facilitate concepts at the pre-operational level. This is an important distinction, since Piaget (1959) asserts that concepts need to be formed at the pre-operational level before you can move onto concrete and formal understanding of any given concept (Piaget, 1959). While using visuals, as well as text, to inform the reader about the world, multiple brain circuits are formulated to increase the brain’s ability to remember any given concept (Pulvermueller, 2005).

Beyond the elementary years, many studies have assessed 6-8 grade students, and found that using student-created visuals, made during the writing process, primed student perceptions that learning grew as they engaged in the writing process (Kajder, 2006; Millard & Marsh, 2001; Pantaleo, 2015).
In a study assessing adolescent language skills, researchers found that the interviewees’ perception of standardized assessments did not grasp their language difficulties (Spencer, Clegg & Stackhouse, 2012). Only after speaking with the students did the evaluators understand that their language functions were not at the expected level that their test scores suggested. This study proposed that even students who are meeting standardized test requirements may not be speaking and writing at the same levels, as indicated by their test scores. (Spencer, Clegg & Stackhouse, 2012).

Studies done involving student drawings in secondary English classes are not generally student-directed like those of the elementary or middles years, but provide results which suggest that using visuals can inform the writing process in positive ways (Wilcox, 2014; Zenkov et al., 2013). According to Vitulli & Santoli’s (2013) study, students created visuals in a multimodal literacy landscape, allowing students to differentiate potential advantages, and disadvantages that living in the digital age can bring them.

However, these studies do not include the analysis of student drawings of concepts to inform their practice. One study does come close, however. The aim of the study by Lazo and Smith (2014) focused on a secondary school in New Zealand that used student interviews and observations to assess within an a/r/tographical framework. A/r/tographical is a method which links art, research, and teaching, and is expressed by students in text and image. The findings, presented as an integration of participant and researcher, voice and the visual, illustrate the profound effects of critical-looking practice through an inquiry framework.
Colombo and Fontaine (2009), in a study of building vocabulary and fostering comprehension strategies for English Language Learners, placed fourth grade ELLs with University Masters, pre-service students who focused on scaffolding, through conversations between classmates. ELLs with specific content-related vocabulary increased the understanding of the concepts for those students. Whether or not our students are ELLs, we can learn much about how to teach language acquisition from those who teach language learners, through accessing their second language or L2. For instance, Schleppegrell (2013) describes design-based research in U.S. schools with a majority of English Language Learners, in which teachers were supported using Systemic Functional Linguistics (SFL), an approach to linguistic that considers language as a social semiotic system, developed by Michael Halliday (1993), to be a metalanguage in the context of curricular activities. This work illustrates how a meaningful metalanguage can support L2 learners in accomplishing challenging tasks in the primary school curriculum, at the same time promoting the kind of focused consciousness-raising, and explicit talk about language, that has been shown to facilitate L2 development.

Gritter, Beers, and Knaus (2013) studied teacher scaffolding of academic language in an advanced placement US history class. The data included four months in observance of teacher instructional strategies to scaffold student writing, and vignettes of student writing, with marked academic language change, over time. The authors conclude that to construct effective arguments in writing, students need narrative continuity across the big ideas of history, and sophisticated language to convey this knowledge in their writing. Teachers can scaffold this as integral to their instruction,
and evidence of success can appear in student writing. The majority of the scaffolding in this study was done through lecture, and creating a narrative for writing. A narrative for writing exists in this study, and is unfolded through the I-story. I start on day one, and complete on the second to last day, when I draw my career path for the students. The Gritter, et al (2013), study is a formal/abstract, top-down model. This study realized gains in functional writing, but did not include any specific drawing or cartooning methods.

**Graphic Organizers as a Potential Tool for Organizing Student Thought.**

While Graphic Organizers are wonderful tools to aid the ability of students to link visual information to their images, for a teacher, creating them with every individual in mind is cumbersome. In the spirit of Lave and Wenger (1991), and creating communities of practice, the following studies show that graphic organizers are a great substitution for notes written on lined sheets of paper. Keeping up with class facts and figures, along with ideas, also need reflection in the theories of Costa (1991), and Bloom (1956), as well as Perkins, to guide us in ways to allow students the power to create their own graphic organizers. Alvermann (1981), in a study of graphic organizers and learning-disabled students shows that each individual ultimately needs to feel comfortable with the graphic organizer itself. We create problems when we remove the learners’ understanding of the process (Foucault, 1965).

Concerning the compensatory effect of graphic organizers on descriptive text, Singleton and Filce (2015), found that the use of graphic organizers to compensate for text was less than optimal in its organization. One hundred and fourteen sophomores read two versions of an expository passage, which differed only in structure
(comparison versus description). Both experimental groups studied a graphic organizer that had been constructed to reflect the comparison text structure. On immediate and delayed recall measures, the experimental groups recalled significantly more than the control groups, under the descriptive text condition only. Results support assimilation encoding theory, and suggest that organizers aid recall when readers must reorganize information, but do not help when reorganization is unnecessary. All students in this study, regardless of reading level, benefited from the use of graphic organizers. The effects of graphic organizers would, and as we will see, further depend on the teacher who is creating the graphic organizer. In all of these cases, the intervention, scaffolding, or differentiated event, as well as the graphic organizer itself, is constructed by the thoughts of someone else. This is antithetical, in a way, to Piaget, Vygotsky, and other constructionists, who would have students themselves, create the meaning. Producing graphic organizers for all is unwieldy, as the all might employ different individual organizational methods. Another way to get around this difficulty is the cartooning intervention. This method allows for students to create, and name, their own thoughts about the concepts they encounter throughout the study.

Lehman (1992) looked for possible solutions to incorporate into the process. Graphic organizers benefit our slow learners; DiCecco and Gleason (2002) showed that allowing the manipulation of information was an exercise for moving the information around, however, these methods are for input into visual memory, and will only stay if they are matched with a task.
By using graphic organizers to attain relational knowledge from expository texts, Douglas, Ayres, Langone, and Bramlett (2011) studied the effectiveness of electronic texts, and pictorial graphic organizers, through which to improve comprehension related to functional skills. They found that students connect literal pictorial representations, found on the internet, to skills they may need in the future. This study used computer generated images, which the students had to associate with the topic, and were chosen by the teacher, rather than the students. Preoperational meaning has to be created in order to understand a concept, and the students in this study would have missed the preoperational ties (Piaget, 1959). They had not personalized the graphic organizer or the pictures, because they had not had a hand in creating the images.

Three studies were done with social studies in particular. In Gallavan and Kottler’s (2007) study there were eight types of graphic organizers for empowering social studies students and teachers. Horton, Lovitt, and Bergerud (1990) examined the effectiveness of graphic organizers, for three classifications of secondary students in content area classes, and they were found to facilitate learning at a greater rate than just writing words. Ciullo, Falcomata, and Vaughn (2015) reported that teachers found that graphic organizers worked best when students were able to formulate their own organizers.

Egan (1999) and Struble (2007) found that specifically using graphic organizers as formative assessment allows for the manipulation of information. This is also the finding in Jiang and Grabe (2007), and Robinson and Kiewra (1995) and shows that teacher-directed graphic organizers, in reading instruction, allow adolescents to
increase connections to text, and life. Research findings, and graphic organizers based on issues, are superior to outlines in improving learning from texts. These results, by Stull and Mayer (2007), as well as McMackin and Witherell (2005), found that graphic organizers present a simple, but effective, tool to help students grasp key concepts.

These studies report that the more personalized the graphic organizer, the more meaning is acquired for the learner from that graphic organizer. If learners create their own cartoon or drawing or notes, they are accessing and recalling their understanding of the subject, and further refining that information to deepen knowledge. Creating their own drawings is best for students, as is keeping the questions grounded. Costa’s (1991) habits of mind, Lave and Wenger's (1991) community of practice, Perkin's (1992) culture of thinking, and Piaget’s (1959) biologically driven progress, in combination with Vygotsky’s (1978) sociocultural historical perspective, demonstrates that a classroom should have room for each person to thrive within this theoretical framework.

**Role of Questioning in Adolescent Language Learning.** As adolescents age into adulthood and gain experience, higher brain functions occur, and conceptual understanding commences at a formal level (Piaget, 1959; Pulvermueller, 2005; Vygotsky, 1978). In literacy education, symbols interact with learners’ visual representations of language, educating adolescents with moving images, and content that can be directly applicable to the learners themselves (Gallese & Lakoff, 2005). Through self-inquiry, and by matching visual patterns to thought, and then describing that process in writing, teachers can expect further improvements in literacy and

Using an inquiry-based process with adolescents allows students to exchange language with partners, and within small groups: to engage in, and get feedback about using language that is academic in nature, and raises cognition (Bruner, 1997; Piaget, 1959; Van Geert, 2000). When learners engage in higher cognitive functions through use of language, whether writing, speaking or reflecting, they are acquiring a greater command of concepts therein. Increasing students’ language function allows them to move from a concrete adolescent worldview to a more formal level of conceptual understanding (Piaget, 1959; Burke & Stets, 2009; Tudge, 1992).

Costa (1991) centers on the need to teach students to think, using the proper conditions in which a designed curriculum engages thought, teaching strategies that allow for thought, and assessing students based on the growth they notice, as well as that of their peers and adults. Conceptual development, ala Yücel, M. (2008) and others, contribute to Costa’s work, takes the focus off the learning of facts and figures, and, instead, focuses on learning habits of mind, or how to question. Bloom’s Taxonomy (1956) of questioning types that lead from simple what questions of definition, to complicated synthesis of information questions, shows us that the more difficult the questioning, the more cognitive ability is displayed, and combined with Costa’s (1991) ideas on habits of mind, form a great empirical addition to Vygotsky and Piaget’s ideas on learning.

Costa & Kallick (2005) lists seven virtues that allow for students to move past facts and figures to questions, as Foucault (1965) would have us do. Those virtues are:
first, persisting (seeing a problem through to the end), second, managing impulsivity (being able to stay at the task at hand), third, listening to others (with understanding and empathy), fourth, thinking flexibly (plasticity of thought-finding solutions), fifth, metacognition (thinking about thinking), sixth, striving for accuracy (assessing and reevaluating goals and objectives), and seventh, questioning and posing problems (observation, data collection, search for causal connections and relationships in this world).

Many of the prescriptions for successful teachers show common themes of strong interaction between peers in paired interactions, small and large group discussions, such as Socratic dialogues, media studies, and language studies in writing and speaking, found in Costa’s (1991) anthology. Certain prescriptions can also be found in Perkins (2004): knowledge arts or creating knowledge, communicating knowledge, organizing knowledge, and acting on knowledge. Much research by Perkins points to the mindful practice of teachers that question, and transfer knowledge from other interests that they already know about, to the new information they are tasked to learn in a community of practice (Perkins, 1992; Perkins & Salomon, 1992; Tishman, Perkins & Jay, 1995; Perkins, 2004). As constructionists, we are set to allow our students to think for themselves, and find their own interests, so that they may join their chosen communities of practice, each buying in at a different point that belongs to the individual (Piaget, 1959, Lave and Wenger, 1991; Vygotsky, 1978).

Vygotsky’s socio-historical dialectic version of adolescent education meets the individual’s biological, ala Piaget, learning mechanisms, and is triggered by the outside stimuli. The students then have some way of organizing a learning
environment, where a great diversity of cognitive abilities exists, such as in a secondary high school classroom, and allows them to learn from each other as well as adults, but still requires adult guidance (Piaget, 1959; Vygotsky, 1978). Having some methods, such as the dynamics of understanding how to engage in community building, as well as working together towards a common goal of covering material, as with those described by Costa (1991), also explore helping students become effective thinkers. Perkins (2004) includes thinking routines, designed around creating a culture of learning through teaching for understanding; both volumes are steeped in constructivist leanings.

**Scaffolding Adolescents’ Academic Language Acquisition through Writing.**

While Academic Language predates new Common Core State Standards, which promote learning concepts pertaining to specific content area study, Academic Language is the basis for much of Common Core standards. As Common Core spreads throughout the country, the push for all students to understand specific concepts for each of the fields of study they engage, acknowledge some recent studies which have taken that notion into consideration, and are worth noting, as they give context to the attempt to teach to all students.

For example, knowing addition is as important to math as learning about government is to social studies; learning specific concepts unlocks other concepts that connect and accelerate learning. Keisler and Bowers (2012), demonstrate the importance of providing explicit instruction in academic language for English Language Learners (ELLs). Three questions guided teachers while planning content area instruction for ELLs and are shared during this study. These three questions are 1)
Which vocabulary words are absolutely essential to students’ understanding of the lesson, and/or unit? 2) What are the functions of language in the text/unit/or lesson? 3) Are there specific features of language that students should know in this lesson or unit? In addition, the authors provide both an example of how they would answer those questions using a segment of content area text, and a template for planning purposes (Keisler & Bowers, 2012).

Cumming (2013) also supports these findings. The author analyzed three phenomena where intersections occur between cognitive skills, personal attitudes, social practices, and macro-societal structures, in ways that are salient, puzzling, and also illuminating as to the multiple dimensions of learning literacy. The author examined, in situations of cultural and linguistic diversity: (a) heuristic search strategies involving language switching, for choices of words and phrases while composing, (b) expressions of personal identity, when writing for specific discourse communities, and (c) reciprocal modeling during dynamic assessments of writing and reading. Examples are drawn from research in Toronto with multilingual students entering university programs, and with at-risk adolescents in a community-based, after-school tutoring program. The findings were: (1) uses of multiple languages strategically as resources, (2) expressions of personal identity in relation to relevant discourse communities, and (3) goals and thinking strategies for planning, self-monitoring, and learning, from literacy tasks by modeling their own behaviors, along with those of more proficient, trusted others (Cumming, 2013). At the same time, students fostered their long-term aspirations for self-development, self-confidence,
and engagement in literacy tasks, for epistemic purposes of expanding personal knowledge.

Systemic Functional Linguistics (SFL) based on Halliday (1993) shows how an underlying semiotic relationship to the visual structures in the brain expresses a need for students to receive information with pictures, so they can see it, moving or otherwise. Academic language is increasingly about being able to function in each subject, based on learning core concepts. These language acquisition based-authors understand this as a detailed individual process that provides the basis for understanding for English Language Learners, which we all are. We have a visual encoding system that allows us to connect language to abstract concepts, and discuss them, in order to create new meaning, and reinforce the understanding one has, as regards the world around them.

Most of the articles about English Language Learners refer to those learning English, while also learning concepts connected to their academic subject matter. A number of authors identify ways to support English Language Learners, specifically in high school social studies classrooms, and are focused on scaffolding individual learners. Wang, Many, and Krumenaker (2008) analyzed reflections from a secondary social studies teacher; Yoder (2013) studied structured academic discussion and academic language acquisition of English Language Learners. Understanding the experiences and needs of mainstream teachers of ESL students these studies found that, as the teacher modified various aspects of teaching to accommodate the needs of ESL students, this facilitated student access to the content, but at the same time created problems that had not been examined, or predicted by past research. This study
exposes the dilemma of providing comprehensible instruction to ELL students, and highlights the role of differentiated instruction in diverse mainstream classrooms, as well as the place of students’ first languages in learning academic content. Many times, learners come to secondary schools in America not truly understanding their first language, which poses problems for learning English.

Scaffolding, intervention, and differentiation, are all used interchangeably, in Education in America, for making sure teachers connect with all learners in their classes, to assure they are learning the material. Szpara and Ahmad (2007) examined supporting English Language Learners in social studies classrooms, and found that content-area instruction for ELLs represents a growing area of instructional need in U.S. high schools. In this article, the authors focus on diverse approaches to developing an effective instructional environment for teaching secondary-level social studies curriculum to ELLs. The authors participated in a school-university partnership to support the efforts of content-area teachers to increase ELLs’ comprehension skills. The authors propose a multi-tiered approach to meet the needs of ELLs in the mainstream social studies classrooms by (1) providing social and cultural support during the process of acculturation, (2) providing explicit instruction in academic strategies necessary for successful comprehension of in-depth content, using the Cognitive Academic Language Learning Approach, and (3) making social studies curriculum more accessible, through strategies for reducing cognitive load, without reducing content (Szpara & Ahmad, 2007). Cummins (1991) shows that ELLs tend to know how to converse with their peers, but creating academic language must be scaffolded into the curriculum by the instructor. Cummins theorizes that in order to
increase Ells' abilities to acquire academic language, they must have more time to learn this language, and more scaffolding to acquire the language. Much planning goes into classroom practices that support ELLs in their ability to learn specific social studies content. Increasingly, a good part of the Professional Development time is focused on scaffolding, interventions, and differentiation strategies.

Results from a study of high school teachers (Short, Fidelman, & Louguit, 2012) indicate that developing academic language in English Language Learners through sheltered instruction, or SIOP, offers a cognitive, psychology-based approach to breaking down the whole into constituent parts for the ELL learner, or any language learner for that matter, so he or she can understand in pieces, build those pieces, and then understand the whole. That may or may not work, based on whether the learner understands meaning behind the instruction. The SIOP model is an approach for teaching content curriculum to students learning through a new language. Teachers employ techniques that make the content concepts accessible, and also develop students’ skills in the new language. Using a quasi-experimental design, Short et al.’s research was conducted in specific content areas, and in English as a Second Language classes, in two districts in northern New Jersey, over 2 years. The analysis presents student achievement data from state-mandated language proficiency tests in the final year of the intervention. This study reported statistically significant differences in the average mean scores, in favor of the treatment student group on Writing, Oral Language, and Total English scores, of the IDEA Language Proficiency Tests, with small to medium effect sizes. The results from this study suggest that the SIOP model offers a promising approach to professional development that can
improve the quality of instruction to ELLs, and increase their English language achievement.

Appropriate wait time, Costa’s levels of questioning, Blooms Taxonomy, think-write-pair and share, are strategies found in SIOP that work in this study. Allowing writing time, and talking time, during class allows learners to access, and practice their language acquisition. These strategies strengthen students’ understanding of concepts during the process, and are all brain-based strategies helping students create meaning through language acquisition.

The similarities, in all these studies, are the talk amongst, and between, students and teachers. The language of social studies fosters communicative abilities that allow these participants to engage in abstract/formal concepts, and creates activities to increase student abilities to complete formal/abstract tasks. Some of the same prior authors, such as Bruner (1990), Costa (1991), Perkins (1992) Piaget (1959), Vygotsky (1978) provide the sources of the same approach in the classroom, by creating environments in which to question and work with peers and adults, and to think about and solve problems that individuals encounter in everyday life.

**Research Gap**

Much has been researched and studied in regards to expository writing, language function, brain-based learning, and student drawing of pictures or cartooning, but there is no single study that puts them together in order to identify how, and why they promote learning in an adolescent population. Brain-based methods can be used to help students make claims, backed with appropriate evidence on a state-based rubric. Teaching to writing assessments, derived from standards at the
national level and brain-based, are new, and require a firm foundation in neuroscience, cognitive psychology, and linguistics in order to form the groundwork for understanding in what ways human beings learn to write. Within this field, new synthesized information is emerging each and every day. However, fieldwork with adolescents is important to study, because the methods of this study are done to provide the reader with information, about teaching and learning, which is new and germane to education in the field today. While much research has been done in discovering how the adolescent brain functions, brain-based approaches that take this feedback into consideration are being developed and interested parties, readers, should know how that research is progressing.
Chapter Three: Methods

The purpose of this study was to investigate whether the use of brain-based pre-writing strategies will improve students’ abilities to support claims, with evidence, on a state mandated classroom-based assessment. Specifically, the research evaluated the working hypothesis that using brain-based, pre-writing activity in the non-fiction, expository writing process will assist students in their performances, as assessed by the Office of the Superintendent of Public Instruction for the state-approved You and the Economy CBA CBA Rubric. By using brain-based strategies as a pre-writing activity in the non-fiction, explanatory, secondary social studies writing process, I hypothesized that those students would demonstrate logical use of claims and evidence in their typed essays.

Research Overview

This research study was guided by two overarching research questions:

1. As brain-based learning strategies are being implemented in real time, what is the nature of the process of using brain-based interventions? In documenting the brain-based interventions, what decision-making factors are considered when designing the unit of instruction?

2. What changes—if any—are demonstrated in student writing performances on a Classroom Based Assessment, when brain-based learning strategies are implemented over the span of a research cycle?

These research questions were answered through a research design, involving a cycle of instruction, and culminating in an explanatory writing sample. By using cognitive psychology theories to refine learners’ concepts and promote learning, I
hoped to improve students’ abilities to make claims, and provide proper evidence for those claims, as measured by the Office of the Superintendent of Public Instruction for the state-approved *You and the Economy* CBA Rubric. The process of my decision-making, as well as student assignments and writing samples, were examined to evaluate the effects of brain-based, pre-writing strategies that students would use to complete the CBA.

Schmuck (2006) and Tomal’s (2003) research approaches were chosen as the appropriate research methodology, because this approach allows for extensive study of teaching and learning in the natural environment of the twelfth-grade classroom. The research process starts with a question-guided plan, followed by action implementation, documentation of the process, then, reflection on the process. In order to better understand the students taught by this researcher, this plan allows the researcher, and participants, to engage in activities and interventions that maximize the teaching and learning, in a community of learners (Elliot, 1991; Hubbard & Power, 1993; Schmuck, 2006; Tomal, 2003). I documented and analyzed the implementation and outcomes via observation, video recording, journaling, informal interviews, the artifacts of student writing interventions, and the writing assessment data. These data were selected to shed light on both the instructional approach, and on student use of brain-based, pre-writing strategies, and processes to influence their claims, and evidence scores, on *You and the Economy* CBA Rubric.

From the score results of the writing assessment, based on claims and evidence section scores from *You and the Economy* CBA, an examination of how to better refine, and implement, brain-based pre-writing strategies was focused on the
assessment of my teaching practices from multiple perspectives. Using brain-based principles of applying care to the presentation of material, that students can see, hear, and touch, allows maximum input of sensory material to connect the learner to the concept presented. In doing so, I hoped to improve students’ abilities to make claims, and provide proper evidence for those claims, as measured by the CBA.

The process of my decision-making, as well as student writing, was to examine and to evaluate the effects of brain-based, pre-writing strategies, which students used to complete the CBA. Once the research process is completed, described, and analyzed, the effectiveness of the instructional approaches, in terms of helping students link evidence to their claims, were reviewed in Chapter 4.

**Research Study Design**

The research questions were answered through involving one cycle of instruction, and culminating in an explanatory writing sample. There were four steps in this cycle consisting of planning, action, reflection, and implications (Schmuck, 2006; Tomal, 2003). The action-research data cycle began with lesson planning steps, in order for the participants to complete the writing sample, *Economy and You* Classroom Based Assessment (CBA).

The next step was to take the participants through the process of information gathering, and synthesis of writing. The writing, or documentation of the learning, as students were engaging with the curriculum, were the artifacts I collected to reflect on the learning process with which students were interacting. The specific lesson planning is described in the Procedures Section below. In this case, the planning was based on cognitive psychology principles, past experiences as a classroom teacher, and
work inside my Contemporary World Problems (CWP) Professional Learning Community (PLC). I also worked alongside two other teachers of the same subject, and, reflecting on that which has worked well in the past, with a similar population of learners cycling through our classrooms.

The planning addresses the topics to be covered in class, and their implementation. The action portion of the data cycle was utilization of ideas, lesson plans, and objectives that have been set out in the planning phase of data cycle number one. Observations, video recording, document collection (teacher assignments and student work), informal student interviews, and instructor reflection were used to document this experience. The reflection step was done in real time with the journal data source, and once the data was collected, throughout the writing and editing. At the end of the unit, the CWP PLC members, along with two other teachers, and I, scored writing samples. The implications section of the study is described in Chapter 5. Upon finishing the data collection cycle, data were reported in Chapter 4 of the findings of this study.

Setting

The study was conducted in a suburban school district, located outside an urban area in the Pacific Northwest. The school district in question is one of the largest employers in the area (3,300 employees), along with other public health agencies, and another school district. Because this area relies more heavily on public health institutions, as well as educational systems, the lack of big employers in this community has left the area with an average income, below both state and national averages. Given that demographic, there were between 50,000 and 80,000 people that
leave this suburban setting for employment, every day. While the adjoining urban area
is one of the largest in the region, the suburban areas surrounding were often the
outlets for growth. Impact fees and taxes were assessed along with federal and state
monies, taxed and levied, to allow for school district to continue raising funds, about
$250 million dollars in 2014-15, to provide an education for the approximately 23,000
students who attended its schools.

This particular public school district has enjoyed success at winning awards on
local, state, and national levels. The school’s system is set up pre-K-5 for elementary
education, 6-8 for middle school and 9-12 for high school. At the middle and high
school levels, students are not particularly tied to their neighborhood schools.
Boundary exceptions may be obtained to attract other general education-type middle,
and high school students, to magnet schools that are focused on public health,
international baccalaureate, STEM, arts, and academics.

The school in the study was a 1,243-member student body. Average student
performance at the school falls below district and state averages. The school’s 10th
Grade High School Proficiency Exams (HSPE) reading scores indicate that 65.3%
passed, while 67.2% passed the writing HSPE. The district average was 77.9% in
reading, and 80.7% in writing; the state average was 82.9% reading, and 85.6%
writing. In the school’s End of Course (EOC), EOC Math Year 1, 38.3% passed, while
14.8% passed the EOC Math Year 2; 51.5% passed the EOC Biology. However, the
district wide scores, 60.7% passed the EOC Math 1, while 26.3% passed the EOC
Math 2, and 70.2% passed the EOC Biology. Statewide, 58.3% passed the EOC Math
1, while 53.3% passed the EOC Math 2 (see Appendix B for student demographics).
Contemporary World Problems and Expository Writing

The Contemporary World Problems (CWP) course is a high school graduation requirement for the state-issued, district-distributed diploma. Completing an OSPI-Developed Social Studies Assessment, at a proficient level, requires students to demonstrate that they have successfully met particular Social Studies Essential Academic Learning Requirements (EALRs). Students can achieve this by applying an understanding of social studies knowledge, concepts, and skills to a specific context that is meant to be relevant to the civic lives of these students. OSPI-Developed Social Studies Assessments are designed to ensure that students employ critical thinking skills, and engage in their own individual analysis of a particular context or topic. The OPSI Statement on Economy and You CBA can be found in Appendix F.

In response to these conditions, our CWP PLC has been delving into interventions that target student achievement in the areas of content, which builds students’ abilities to substantiate their claims with evidence. Our CWP PLC believes that improving our CWP students’ writing this year hinges on developing research-based methods to improve learners’ capabilities to make claims, and support those claims with relative and valid evidence. In response to this evidence, the study incorporated the brain-based interventions that were suggested by cognitive psychologists as pre-writing strategies, in order to assess the degree to which these approaches improve students’ informational writing on the CBA. As noted in the literature review, numerous studies have suggested that drawing as an intervention can be used to tap into students’ visual concepts, and those concepts tied to writing.
Participants

Students that participated were identified by encrypted initials JV, RE, KG, JC, JRC, and DM, to hide their identity. JV is a Hispanic male 18 years of age. RE is a Hispanic male 18 years of age. KG is an African-American female. JC is a white student on free and reduced lunches; JRC is an English Language Learner, enrolled in a sheltered, instructional intervention through the school district. JRC, a free and reduced lunch recipient, speaks Spanish at home, and translates for his parents when they need to communicate in English; they do not speak English. DM is on an IEP for motor and auditory learning support. DM is a white student, who is also a free and reduced lunch recipient through the school district.

Role of the Researcher

I was a full participant in the study, and was the teacher of record for these students. I began my career at this school seven years ago, and also attended the school, graduating in the early 1990’s. A potential pitfall in action research is that the teacher, as researcher, may have many potential biases at work (Halo Effect, Leniency Effect, Central Tendency and Contamination), in the observation of his students (Tomal, 2003). This study drew on multiple resources to acknowledge, and offset, those potential biases. In educational research, teachers engage with the culture of their students; it is part of our own data collection directed by the district, state, and national law. My teacher evaluation has criteria related to culture; educational research backs the idea that creating culture, conducive to learning in the classroom, is a best practice. This research was conducted as I interacted with student subjects, while making observations and presenting material in a school setting (Elliot, 1991; Hubbard
& Power, 1993; Schmuck, 2006; Tomal, 2003). Researcher bias was addressed by the triangulation of data collection methods and analysis (Elliot, 1991; Hubbard & Power, 1993; Schmuck, 2006; Tomal, 2003). For example, while collecting data, I was also teaching. My instruction methods were analyzed and reflected upon, in note taking form, in a journal, (Elliot, 1991; Hubbard & Power, 1993; Schmuck, 2006; Tomal, 2003), as well as through external observation and video-recording, and analysis of classroom artifacts (teacher created materials and student work).

Data Collection

A set of brain-based procedures found in cognitive psychology literature was applied: including extensive interview notes, journaling, observation, and recorded language. In addition, spoken artifacts, such as conversations in class, and written artifacts, such as assignments, informed my study (Elliot, 1991; Hubbard & Power, 1993; Schmuck, 2006; Tomal, 2003).

Instructional Procedures

Cognitive Psychologists, especially Piaget (1959), Bruner (1990) and Vygotsky (1997), substantiated by many others across cultures and languages, have come to discover that child development spans levels of understanding, from sensorimotor to preoperational, and from concrete to formal or abstract thought. Over the year, we have covered the Economy, and built towards an abstract concept that features many entry points for students. A more detailed account of the sociocognitive development of children, specifically adolescence, can be found in Chapter 2.
The Daily PowerPoint Agendas in the Teacher Journal

Days 1-3, preoperational conceptual information presented to students. The most prescient learning comes for all of us at the preoperational level; this is how the world affects us as individuals with the most impact. Humans learn from experience (Piaget, 1959). I introduced the topic of You and the Economy CBA, on May 10, with a video “U.S. News & World Report reveals best jobs of 2016,” https://www.youtube.com/watch?v=f3eFLfS2o84 and then told each class an I-story about how I chose my career, more specifically my career goals, and what I wanted to accomplish with my life. I allowed students to listen to my I-story, and tie that to themselves. I then have an example of an I-story that, as I am telling my I-story, their own I-stories are developing in regards to You and the Economy CBA, and now the participants are also tied into these concepts (Arwood, 2011; Piaget, 1959). This is a deliberate attempt to engage students in understanding the world around them, so they establish a direct preoperational understanding of the concepts, before any concrete or formal/abstract thought can take place (Piaget, 1959). Students are ready, once they have a preoperational understanding, to take the next step, and understand how these concepts interrelate as they move to a concrete, and then a formal, or abstract, level of sociolinguistic understanding (Piaget, 1959).

"Draw yourself into the current economy" is the prompt that I assign students to complete, in class, on an 11x17 piece of paper. This assignment stresses the connections needed to move the learners from a preoperational understanding, to a concrete, and then formal/abstract understanding (Arwood, 2011; Piaget, 1959). How the economy relates to the student, in a single pane drawing, will allow students to
draw a preoperational picture that relates to them directly, and allows students to visualize the pictures in their heads, so as to establish a better idea about how their concepts interrelate (Piaget, 1959; Vygotsky, 1978). As I introduced this topic to the students, I was implicitly concerned that they should connect with the economy in a preoperational level. According to sociocognitive development theories outlined by Vygotsky (1978), all learners engage best with a topic when it applies directly to them. By introducing the material personally to the learner, the learner can access it directly. In this way, the brain integrates new material into its schema. Personal connection allows the maximum number of learners to get on board with the assignment. Since it was about them, it seemed easy to them; they worked with others, and then shared their language with others. All of these students’ engagement tactics allowed them to have maximum understanding of the concepts introduced.

When accessing knowledge, an adolescent’s first inclination is to draw, and write, to what they know from their direct experiences. This is a hallmark of preoperational thinking, which needs to proceed to concrete, and subsequently formal thinking, in order for each learner to have maximum semantic displacement of understanding of the given concepts, such as Economy, which we are learning in this unit (Hockett, 1960; Piaget, 1959). This exercise allowed students to access long-term memory in their visual centers, across the parietal lobe that stores long-term visual memory (Baars & Gage, 2010). As this is a preoperational, social cognitive task, students are allowed to enter the ground floor of the concept of the economy, as it affects each student directly. Through helpful reminders from me, and working the room, as well as by checking in with each student 3-5 times in any given time frame of
work, students were allowed the flexibility to work on their own, and benefitted from my being able to give constructive guidance to students who were experiencing difficulties materializing their ideas into action (Bruner, 1990)

On the back of 11x17 paper, students created a drawing prompt. Students then were asked to list their career and job goals. In each class, I divided the class into groups of 5-8, in order to generate small, table-based, group discussions of their drawings with their neighbors, and allowed them to exhaust the preoperational topic. This encourages the discussion to move to the concrete: to how the economy works, and whether they are a part of it, or not. Concrete thinking, not only about the economy, moves from an understanding of how the economy affects them and those around them, but also into how the economy operates in the local, national, and international setting (Piaget, 1959). For the introductory concrete task that would incorporate formal/abstract sociolinguistic functions, we watched *How The Economic Machine Works* by Ray Dalio, [https://www.youtube.com/watch?v=PHe0bXAIuk0](https://www.youtube.com/watch?v=PHe0bXAIuk0).

**Days 4-10, moving students from preoperational conceptual understanding to concrete.** Once this film was complete, the discussion that took place introduced macroeconomic concepts that operated as our picture dictionary assignment, which was scheduled towards the end of the unit. Closer to that assignment, each class chose a list of concepts they identified, and that needed to be defined, in order to write for the *You and the Economy* CBA. Students were instructed to email me three articles that related to their career choices, and three examples of companies that students could work for. These questions, as well as research, were assigned to give the students concrete and formal, or abstract, concepts. These concepts were associated
with higher sociocognitive levels of thinking, higher than those at the preoperational phase where we started with single pane drawings. Students were asked to send those articles, and find those companies they could work for, by class the next day. This class was extended from its normal 52-minute period to an hour and 50 minute classes, to accommodate state testing.

In the next lesson, the class and I reviewed what we had found in the articles that students submitted, and I sent students feedback via email. Students began to turn in their drawings, and most others continued to work during the video. The video was introduced, using specific language to make sure that learners comprehended the interconnectedness of the national and international picture view of the economy. This was accomplished via a short Netflix film from Morgan Spurlock, entitled *We the Economy: The Ebola Economy.*

[https://www.netflix.com/watch/80058032?trackId=14170286&tctx=6,2,a0e9151a-ed97f32-976b-cfc741adae06-237227414](https://www.netflix.com/watch/80058032?trackId=14170286&tctx=6,2,a0e9151a-ed97f32-976b-cfc741adae06-237227414). This video has a good preoperational national tone that allowed students to connect to a larger concrete, then to formal/abstract ties with a global understanding of economy, beyond the concrete understanding, of what is happening nationally. At the end of class, students were asked to list the top three employers in our local county for the next class. This preoperational to concrete sociocognitive allowed for the following day’s beginning discussion to center on where students could look to find steady employment in the local economy. Both classes noted that the largest employers in the county were school districts and healthcare providers, on par with the jobs for 2016 US News and World report, which we had substantiated during our first lesson.
In our discussion we focused on the differences between entry wage, and more skilled wage jobs, within the economy. Through information I gathered in our large group discussion, I chose to focus our attention on what it is like to live a day, both as a top wage earner in America, and as a minimum wage earner in America. We focused our lens through Episode 7, Season 2, of CNN’s original series, Morgan Spurlock Inside Man titled Income Inequality. The discussion, post-video, centered on what it might take for students to unite the career and life goals they have chosen, and align that with the life they would like to live. These are concrete concepts, which, when combined and interwoven with one another, and as relationships start to form between these interrelated concepts, provided for many students to become more aware of specific concrete concepts interacting. Students could now see formal/abstract concepts and could name them with the language used by individuals in groups, small and large. Students had already visually represented these concepts in preoperational drawings, but now, information that we had presented in class in the form of video and discussion, had moved in concrete to formal/abstract thought for a while, but had not yet been seen on paper (Piaget, 1959). Now, students needed to move from concrete and formal/abstract speaking thought, to writing thoughts, which were helpful for students to define in pictures, and enable them to match the concepts for the CBA writing.

I introduced an idea for a future assignment, the Picture Dictionary, to both classes, in order to get them ready for the formal/abstract task of the CBA, and to move student understanding from preoperational to concrete, to a more concrete to formal/abstract understanding, which is the goal of this assignment. I specifically
introduced the discussion question, “What concepts have we learned thus far, from the information presented to you, do you think you will need to define prior to writing the CBA?” From that discussion, the answer which 3rd period chose was (1) Borrowing, (2) Lending, (3) Taxes, (4) Income, (5) Budgeting, (6) Credit, (7) Debt, (8) Cash, and (9) Interest. Fifth period chose (1) Borrowing, (2) Lending, (3) Assets, (4) Liability, (5) Budgeting, (6) Credit, (7) Debt, and (8) Cash. Once the class lists were chosen, students physically drew the pictures they had in their brains around these selected concepts. Over the next three to five days, in class, students finished their picture dictionary assignments. Once their 11x17 drawings were completed, we placed the concepts in alphabetic order with labels, to make sure all students understood, in a concrete and formal manner, how their jobs will affect their future lives. Students were instructed to email me three articles related to their chosen job and career goals. Next, a preoperational to concrete assignment allowed for their articles to be collected, for the formal/abstract task of writing *You and the Economy* CBA. In this writing task, students needed to cite sources, in order to score maximum points on the state rubric.

**Days 11 – 15, moving students from concrete to formal/abstract conceptual understanding.** This *picture dictionary* assignment produced a set of drawings that helped move the students’ thinking from preoperational to concrete, and then to formal. As students made deeper connections to their future employment, they engaged with the concepts in a refined manner. Now, they have added information to their thinking through Piaget’s (1959) accommodation, while working in a group social setting, which Vygotsky (1978) described as an apt motivator for adolescents' behavior and speech. Peer groups, at this point in their development, are more of an
indicator about how their thoughts are expressed, as observed by talking with other peers, in small and large groups. They learn from one another, as much as from the teacher or curriculum, and these, essentially, are the notions as argued by Bruner (1990), Piaget (1959) and Vygotsky (1978) in their seminal works. As they integrate this information, learners are engaging on a more often concrete and formal/abstract sociocognitive thought process, rather than a more preoperational manner of “what can I do to make a living,” and not “what do I have to offer to the world.”

In order to show the students some formal examples of boom and bust economies that reveal the concepts we are defining as we work on our Picture Dictionaries, we watched Last Week Tonight with John Oliver: North Dakota, https://www.youtube.com/watch?v=jYusNNldesc, and discussed (1) Borrowing, (2) Lending, (3) Taxes, (4) Income, (5) Budgeting, as well as, Assets, Liability, and Budgeting. In classroom discussions, students had seen this play out, as defined by the recent Bakken Oil Boom in North Dakota. Furthermore, I presented both classes examples of (6) Credit, (7) Debt, and (8) Cash as exhibited in the video segment titled, “On the Streets of The Greek Financial Crisis,” https://www.youtube.com/watch?v=nDfOFzAKB-w. Both videos gave the students an in-depth look at the real-life implications of concepts that the students chose to explore, in order to help them write their CBAs. The last example I gave, of economic scenarios carried out in the global economic culture, included the effects on the US and each student. For this they watched The Crisis of Credit Visualized – HD, https://www.youtube.com/watch?v=bx_LWm6_6tA. I emailed the students a detailed list of sources cited for each of our videos, so they would have easy access to citing
those sources. This sourcing scaffolded enough learners to achieve easily transposed sources to correctly cite sources. I also spent class time, in the beginning of the unit, on mini-lessons regarding citation of sources, and the expectation of the rubric, to six different class periods, explicitly. Although this was not a focus of the study, citation of sources is covered in the rubric.

A prompt was given to focus the students on writing, and move them into abstract or formal thinking by connecting these larger economic concepts, in order to write a CBA. The prompt was:

How will your career choices effect the local, national and, or, global economy with examples, claims and evidence. Furthermore, analyze the capitalistic, economic system throughout the global economy, how this analyses affects my choices. Examples need to be given. Use SEE statement sentence, and paragraph writing, make claims, and cite them with evidence.

Students were given twenty silent minutes to write this essay. Students were comfortable with Statement Evidence and Evaluation (SEE) statements taught in our English and Social Studies Departments. They offered students a reminder that each argument statement they make, in an essay or presentation, must have accompanying evidence, which it draws from, and an evaluation of the evidence by the writer, in order for the writer to evaluate the evidence. That evidence is then presented in a manner that is logical to the reader, and which will be recorded ultimately on their CBAs.

Cartooning was the last intervention prior to the CBA due date. This process asked students to use 11x17 paper to draw their concepts, based on the ideas presented
during the *You and the Economy* CBA. I spent about twenty minutes drawing my own cartoon, which I prepared, and explained as I drew. This process allows the students to see how using cartooning can assist them, as a prewriting technique, or visual organizer, for their CBA writing, which is due as the final product. This prompt was completed by the respondents; “with all you have learned in the last few weeks about *You and the Economy* CBA, draw yourself into the current economy.” Students were given twenty minutes to complete this in class. The drawings elicited feedback from other students as well as the researcher, and informed the treatment group of their writings, which were to be scored by the *You and the Economy* CBA Rubric. This assignment was given on a Friday, and the *You and the Economy* CBA was handed in on the following Monday.

**Data Source One—Teacher journal**

In the journal, annotated notes appeared as to theory, and my teaching actions carried out in class were noted. As I interacted with students during informal class interviews, brain-based interventions were applied, established in theory, and explained in the teacher journal. I kept this journal, and focused the journal writing to make sure that observations regarding student information on claims, and proper evidence were noted, kept in one place, and could be referred back to during the study to analyze information, to fact check, and to keep track of interventions made with individuals, groups, and the class, for data analysis, conclusions, and recommendations. Participant observation is a valuable tool to monitor student progress, and to supplement material for those that need it, as well as to make sure that student goals are met, and moved toward completion of the artifacts to be analyzed
and reported. Teacher observations of students’ work with their claims and evidence were captured in the journal at the time, and then expanded after the class session has ended, in order to make sure and capture information as it happens.

Journaling plays an important part in tracking the movement of students towards the concepts needed to complete this writing, as well as offering a place to keep track of interventions made with groups of students, as well as individuals (Elliot, 1991; Hubbard & Power, 1993; Schmuck, 2006; Tomal, 2003). I used research memos to capture my interpretations in my journal; I allowed for conclusions, so the journal is a data source, and the memos interpreted the journal. In data analysis and management, I used descriptive coding. Logical titles were assigned, so that the process of reading through the teacher journal, classroom artifacts, and notes made on the margin from initial codes will be ensured (Elliot, 1991; Hubbard & Power, 1993; Schmuck, 2006; Tomal, 2003). The setting, along with the participants and events were captured as well, so that classifying for themes and patterned regularities could be applied (Elliot, 1991; Hubbard & Power, 1993; Schmuck, 2006; Tomal, 2003). Interpretation, and making sense of the findings, was represented in a narrative presentation augmented by tables, samples of student work, scores, and audio and video recordings (Elliot, 1991; Hubbard & Power, 1993; Schmuck, 2006; Tomal, 2003). Beyond the journal notes, motifs or reoccurring themes from student experiences and artifacts, and in-class interviews were examined, explored, and coded (Elliot, 1991; Hubbard & Power, 1993; Schmuck, 2006; Tomal, 2003). These motifs of the reoccurring themes originated from this research, and guided the study’s outcome.
Data Source Two—Video Recording

Classroom video recordings are key instruments in making the interventions needed to encourage students to complete assignments and learn material. Using a school video recorder, a student recorded whole segments of class time with the focus on me, not students. The study used to verify that material I reported in this study was, in fact, what the video captured. No use of participants or their actions was disseminated via this videotape artifact. From these data sources, the findings were used to see if the interventions I was making in the classroom were as I had designed them. A teacher observation form, based on state teacher principal and teacher evaluation program, was used to ensure that my actions met my descriptions in this study.

In this first part of the question, the video was valuable in corroborating that the procedures were followed, as well as the methods of Bruner (1990), Piaget (1959), Lenneberg (1970) and Vygotsky (1978). Ultimately, the video gave me an evaluation tool to measure against the other data sources, so as to ensure what transpired. While it did not capture every single minute of every single class, the video recording validated the other data sources, and therefore was a valuable tool. As I mentioned earlier in this section, video recording also authenticates data from data sources, four student assignments, student interviews, and writing samples. Evaluating the data provided by the video allowed me to validate information from not only the data set based on my actions, one through three, but also how these data integrated with the student data.

The video recording implementation was intended to capture video and sound, to verify that the report in this study is accurate. Three of the four observations were
caught on camera, and the notes provided by the observer from data source three corresponded with the video recording, as well as with data source one, the teacher journal. The video also backed up data source five, student interviews. From the video, I was able to establish evidence, found in in the student interviews, which also confirmed data connected to data source four, and the procession of work of many of the participants in this study. Conversations caught on tape allowed for comparisons by students during the student assignments, data source five, to observe what this data revealed about their thinking or writing in data source six, the You and the Economy CBA writing sample. The video recording verified the accuracy and the validity of the data collected. The nature of the brain-based interventions, in the first part of research question one, is substantiated through the video data.

The implementation of the video was not without a hitch. Because of issues with video taping at the beginning of the study, I was not able to coordinate with the student video camera operator to capture the first five days of the study. Nothing of the preoperational exists in video form. During the videotaping of day eleven, the sound was not captured. The videotape was consistently shot during one class period, so no video data was captured from one set of participants. For this gap, I relied heavily upon notes from data source one, as well as data source three, observations. One of the four observations occurred during the class without video evidence. The evidence from the observation, and the teacher journal, clearly indicates that, while many of the learners in this study participated, there was an issue with three students which seemed to take much of my time away from the material. Multiple distractions occurred during this observation, and a trend emerged between the two classes.
Fifth period was constantly videotaped, and was significantly smaller than the third period class. Third period had 32 rostered, and fifth, 26. While that does not seem like an important distinction, checking the grade book revealed the average daily attendance of the class hovered around 30 for third period, and 15 for fifth period. Because I could not find a volunteer who would videotape, so as to keep the focus on me rather than students, there was no way to accurately videotape the study during third period. In hindsight, I would have had a tape recorder as backup, and carried that with me to make sure that there was a backup record of all that transpired.

**Data Source Three—Observations**

Administrators and teachers had been invited to sit in while these lessons were taught. This was a valuable source of feedback for this study. A teacher observation form, based on state teacher principal and teacher evaluation program, was used to ensure that my actions meet my descriptions in this study.

**Data Source Four—Classroom Artifacts and Student Assignments.**

Teacher-created handouts, and samples of students’ written work, were gathered each day. Artifacts that cannot easily be collected were captured via School District-issued, iPad-produced video. Pictures of classroom activities, and pictures of the student representations, were captured, and informed the study of practices and interpretations of discourse within the classroom (Elliot, 1991; Hubbard & Power, 1993; Schmuck, 2006; Tomal, 2003). Feedback that was given on the assignments was documented and analyzed.
**Date Source Five—Student Interviews**

Interviews were oral conversations conducted during the writing process, in order to provide feedback to the participants. Questions, comments, or concerns that needed further explanation by me were explored, and documented. Questions by students, and answers that encouraged tying claims to evidence, were used to make sure that students were tying the appropriate evidence to their essay claims. These strategies were evaluated for effectiveness and commented on in the journal. Other strategies during student work time to help students organize their drawings included: open ended interview questions to the students asked by the researcher, and written compositions to illustrate conceptual knowledge. These strategies were annotated, cataloged, and analyzed for brain-based artifacts (Elliot, 1991; Hubbard & Power, 1993; Schmuck, 2006; Tomal, 2003).

**Date Source Six—Student Writing Sample**

The writing sample, *You and the Economy* CBA was turned in, and graded by two other teachers and me. The writing sample Cultural Interactions CBA was completed prior to this study, and was completed by eleven of eighteen members of the study. On the last day of the study, the writing prompt, *You and the Economy* Class Based Assessment (CBA), was completed and scored, via the Office of the Superintendent of Public Instruction for the State approved *You and the Economy* (CBA) Rubric. This rubric was approved by OSPI in 2008, and is backed by eight different State Grade Level Expectations (GLE) or Essential Academic Learning Requirements (EALR), and is used in related studies to measure student writing. *You and the Economy* (CBA) will be used to guide the interventions that are implemented in the procedures section.
The *You and the Economy* CBA is an explanatory essay that asks for analysis from multiple sources, so the students will take a position, and defend that position using claims and evidence. This has been an issue for students in the past. *You and the Economy* is challenging, asking the students to take different points of view within their topic in order to see other sides of the issue. Multiple drafts and edits between students and instructor, with feedback, were common practice in this class. Feedback was provided during multiple class sessions, to ensure that students understand their writing prompts, and are writing to the *You and the Economy* CBA paper. This process was designed to give ample time for students to revisit and refine their claims, and back them with proper evidence, and for me to give them guidance on how to make their arguments stronger with the evidence that is presented in the curriculum. Written feedback was noted on a chart to allow comparison across the two cycles.

**Student Writing Samples**

State GLEs that were assessed in *You and the Economy* CBA are as follows: 5.4.1 evaluates positions and evidence to make own decisions in a paper or presentation; 2.2.1 analyzes and evaluates the advantages, and disadvantages, of different economic systems for countries and groups of people; 3.2.2 analyzes the social and political factors affecting cultural interactions; 5.4.2 creates strategies to avoid plagiarism and respects intellectual property when developing a paper or presentation; 5.2.2 evaluates the validity, reliability, and credibility, of sources while researching an issue or event. 5.2 uses inquiry-based research, and 5.4 creates a product. Requirements for the *You and the Economy* CBA, written specifically for State 12th graders, as well as grading indicators, scores, and rubrics can be found in Appendix F.
Data Analysis

Analysis of gathered data, both in the short-term cycles that can be adjusted from the first to second, and in the longer-term cycles, included comparisons across the data sources. Using a data management system, reading the data and taking notes, describing the phenomena, classifying the data, interpreting the data, and representing the data visually, were all key components of this research design (Elliot, 1991; Hubbard & Power, 1993; Schmuck, 2006; Tomal, 2003). Students’ work was blind scored with student numbers. In order to create inter-rater reliability, two colleagues and the researcher, all trained in State CBA, independently rated or graded each essay. If there was more than a point difference between raters, then a third grader, also trained in the State CBA, stepped in to rate the student’s essay.

Validity/Trustworthiness of the Research Design

The case for the trustworthiness of this study determined it to be a well-designed, dependable study, having all the hallmarks of a study that matches the results with the data presented, and with multiple perspectives sought in the data collection and analysis. Along with the methods of this research study, all of these criteria present a strong argument for the validity of the study (Elliot, 1991; Hubbard & Power, 1993; Schmuck, 2006; Tomal, 2003). Extensive notes and data collection offered an audit trail that ensured that the data collection and analysis were adequate for the study, and elicited accurate findings, along with rich and thick descriptions, throughout the data collection and analysis. All strategies were employed to make sure that transferability of this study could mean something to any potential reader (Elliot, 1991; Hubbard & Power, 1993; Schmuck, 2006; Tomal, 2003). In this research study, data from the
researcher, study participants, and reviewers, needed to be addressed through triangulation, member checking, and the audit trail. Member checking was completed by dialoging with the student participants in an open class discussion session, where I spoke with the class about the steps, and the content of the study, and asked if there were any questions, comments, or concerns. Students confirmed that indeed the steps laid out on the PowerPoint Document matched what actually happened as written, in this study. I confirmed that the steps I designed and followed were actually confirmed by the student participants. By planning to collect data from multiple sources, this research could capture the multiple realities in which we exist (Elliot, 1991; Hubbard & Power, 1993; Schmuck, 2006; Tomal, 2003).

Triangulation using multiple sources allowed me to be confident in the findings (Elliot, 1991; Hubbard & Power, 1993; Schmuck, 2006; Tomal, 2003). Two language samples, based on the Office of the Superintendent of Public Instruction for the State-approved Cultural Interactions and (CBA) Rubric, and Common Core Standards, observations, journals, and interviews, offer triangulation of the data to make sure of the reliability and rigor of this study (Elliot, 1991; Hubbard & Power, 1993; Schmuck, 2006; Tomal, 2003). By planning to collect data from multiple sources, this research methodology can capture the multiple realities in which we exist (Elliot, 1991; Hubbard & Power, 1993; Schmuck, 2006; Tomal, 2003).

**Ethical Considerations**

All data were de-identified and the identity of all participants is inaccessible to anyone outside the legal scope of teacher-student confidentiality agreements; all laws and protections for student identity were followed under the Family Educational
Rights and Privacy Act (FERPA), as were all Institutional Review Board considerations through the University with which I was affiliated. I took every precaution to protect the right of those students unwilling to consent to this study, while continuing to make sure that the highest educational standards were presented. The outcomes of all students towards the curriculum were set, and based on district, state, and national policies (Elliot, 1991; Hubbard & Power, 1993; Schmuck, 2006; Tomal, 2003). I spoke to the participants, or class, about the study without deception, and only spoke of the study with general information, instead of specific information, in a manner that protected other participants’ rights to privacy (Elliot, 1991; Hubbard & Power, 1993; Schmuck, 2006; Tomal, 2003). All data collected will be kept on property of the public school entity that checked out a laptop, and iPad device, to me in my capacity as a secondary teacher. While a master list was kept on the hard drive of each device, all other data that was replicated and manipulated was also kept on these separate data bases, as well as Google documents under my password protected email address (Elliot, 1991; Hubbard & Power, 1993; Schmuck, 2006; Tomal, 2003). Microsoft Word and Excel were the preferred applications I used to collect and interpret the data presented throughout this study (Elliot, 1991; Hubbard & Power, 1993; Schmuck, 2006; Tomal, 2003).

Limitations of this study include the small number of students this study surveys. Because of this limitation, the generalization of this data might not be transferable to other populations. While the literature supports the conclusions of this research, and we will see that it fits into the understanding of adolescent education, the question is, will this data be recognizable to others in the field that do not teach the types of
learners found in this study. The procedures that were carried out may, or may not, have been in the order that many constructivists theorists may, or may not, find useful to students' abilities to retain, recall, and implement any information they have learned as a result of taking part in this study. The subjective nature of constructivist education itself is indicated by its wildly differing interpretations on how to currently order, include, or exclude, pieces of this intervention over another.
Chapter Four: Results

The purpose of this study was to investigate whether the use of brain-based pre-writing strategies will improve students’ abilities to support claims, with evidence, on a state mandated classroom-based assessment. Specifically, the research evaluated the working hypothesis that using brain-based, pre-writing activity in the non-fiction, expository writing process will assist students in their performances, as assessed by the Office of the Superintendent of Public Instruction for the state-approved You and the Economy CBA CBA Rubric. By using brain-based strategies as a pre-writing activity in the non-fiction, explanatory, secondary social studies writing process, I hypothesized that those students would demonstrate logical use of claims and evidence in their typed essays.

This research study was guided by two overarching research questions:

1. As brain-based learning strategies are being implemented in real time, what is the nature of the process of using brain-based interventions? In documenting the brain-based interventions, what decision-making factors are considered when designing the unit of instruction?

2. What changes—if any—are demonstrated in student writing performances on a Classroom Based Assessment, when brain-based learning strategies are implemented over the span of a research cycle?

As described in detail in chapter 3, the data sources were split into multiple streams: (1) teacher journal, (2) video recording, (3) administration observations, (4) classroom assignments, (5) student interviews, and (6) student writing samples. Sources 1, 2, 3 were oriented toward the administration of the study and 4, 5, and 6
were student centered, and were used to analyze student progress throughout the study. In addressing the data from the teacher journal, video-taping and observations, I used the data from the first set of three teacher-based data sources, and compared them to the data set from the student-based data sources.

Research question one was examined from data set one, and research question two was examined from data set two. I present the data sets together, both to offer a synthesis of the data sources, and to determine the results of the study that are explained throughout this chapter.

In this unit of instruction, I outlined the first five days for preoperational to concrete thinking-style activities, and sociocognitive language building processes, to help students acquire language through gaining meaning from substantive video evidence, and significant peer to peer, and teacher to student-based conversations. The middle of the study days, 6-10, focused on creating time and space for students to create meaning and expand language, so that they could practice their understanding, and describe that understanding in writing, for the CBA at the end of the unit. The middle of the unit was designed to move students from a concrete to formal/abstract sociocognitive understanding. In the final week, the students were faced with increasingly difficult tasks that mimicked the formal task of writing the CBA.

**Instructional Procedures**

Cognitive Psychologists, especially Piaget (1959), Bruner (1990) and Vygotsky (1997), substantiated by many others across cultures and languages, have come to discover that child development spans levels of understanding, from sensorimotor to preoperational, and from concrete to formal or abstract thought. Over the year, we
have covered the Economy, and built towards an abstract concept that features many entry points for students. A more detailed account of the sociocognitive development of children, specifically adolescence, can be found in Chapter 2.

**The Daily PowerPoint Agendas in the Teacher Journal**

**Days 1-3, preoperational conceptual information presented to students.** The most prescient learning comes for all of us at the preoperational level; this is how the world affects us as individuals with the most impact. Humans learn from experience (Piaget, 1959). I introduced the topic of *You and the Economy* CBA, on May 10, with a video “U.S. News & World Report reveals best jobs of 2016,” https://www.youtube.com/watch?v=f3eFLfs2o84 and then told each class an I-story about how I chose my career, more specifically my career goals, and what I wanted to accomplish with my life. I allowed students to listen to my I-story, and tie that to themselves. I then have an example of an I-story that, as I am telling my I-story, their own I-stories are developing in regards to You and the Economy CBA, and now the participants are also tied into these concepts (Arwood, 2011; Piaget, 1959). This is a deliberate attempt to engage students in understanding the world around them, so they establish a direct preoperational understanding of the concepts, before any concrete or formal/abstract thought can take place (Piaget, 1959). Students are ready, once they have a preoperational understanding, to take the next step, and understand how these concepts interrelate as they move to a concrete, and then a formal, or abstract, level of sociolinguistic understanding (Piaget, 1959).

"Draw yourself into the current economy" is the prompt that I assign students to complete, in class, on an 11x17 piece of paper. This assignment stresses the
connections needed to move the learners from a preoperational understanding, to a concrete, and then formal/abstract understanding (Arwood, 2011; Piaget, 1959). How the economy relates to the student, in a single pane drawing, will allow students to draw a preoperational picture that relates to them directly, and allows students to visualize the pictures in their heads, so as to establish a better idea about how their concepts interrelate (Piaget, 1959; Vygotsky, 1978). As I introduced this topic to the students, I was implicitly concerned that they should connect with the economy in a preoperational level. According to sociocognitive development theories outlined by Vygotsky (1978), all learners engage best with a topic when it applies directly to them. By introducing the material personally to the learner, the learner can access it directly. In this way, the brain integrates new material into its schema. Personal connection allows the maximum number of learners to get on board with the assignment. Since it was about them, it seemed easy to them; they worked with others, and then shared their language with others. All of these students’ engagement tactics allowed them to have maximum understanding of the concepts introduced.

When accessing knowledge, an adolescent’s first inclination is to draw, and write, to what they know from their direct experiences. This is a hallmark of preoperational thinking, which needs to proceed to concrete, and subsequently formal thinking, in order for each learner to have maximum semantic displacement of understanding of the given concepts, such as Economy, which we are learning in this unit (Hockett, 1960; Piaget, 1959). This exercise allowed students to access long-term memory in their visual centers, across the parietal lobe that stores long-term visual memory (Baars & Gage, 2010). As this is a preoperational, social cognitive task,
students are allowed to enter the ground floor of the concept of the economy, as it affects each student directly. Through helpful reminders from me, and working the room, as well as by checking in with each student 3-5 times in any given time frame of work, students were allowed the flexibility to work on their own, and benefitted from my being able to give constructive guidance to students who were experiencing difficulties materializing their ideas into action (Bruner, 1990)

On the back of 11x17 paper, students created a drawing prompt. Students then were asked to list their career and job goals. In each class, I divided the class into groups of 5-8, in order to generate small, table-based, group discussions of their drawings with their neighbors, and allowed them to exhaust the preoperational topic. This encourages the discussion to move to the concrete: to how the economy works, and whether they are a part of it, or not. Concrete thinking, not only about the economy, moves from an understanding of how the economy affects them and those around them, but also into how the economy operates in the local, national, and international setting (Piaget, 1959). For the introductory concrete task that would incorporate formal/abstract sociolinguistic functions, we watched How The Economic Machine Works by Ray Dalio, https://www.youtube.com/watch?v=PHe0bXAluk0. ).

Days 4-10, moving students from preoperational conceptual understanding to concrete. Once this film was complete, the discussion that took place introduced macroeconomic concepts that operated as our picture dictionary assignment, which was scheduled towards the end of the unit. Closer to that assignment, each class chose a list of concepts they identified, and that needed to be defined, in order to write for the You and the Economy CBA. Students were instructed to email me three articles
that related to their career choices, and three examples of companies that students
could work for. These questions, as well as research, were assigned to give the
students concrete and formal, or abstract, concepts. These concepts were associated
with higher sociocognitive levels of thinking, higher than those at the preoperational
phase where we started with single pane drawings. Students were asked to send those
articles, and find those companies they could work for, by class the next day. This
class was extended from its normal 52-minute period to an hour and 50 minute classes,
to accommodate state testing.

In the next lesson, the class and I reviewed what we had found in the articles that
students submitted, and I sent students feedback via email. Students began to turn in
their drawings, and most others continued to work during the video. The video was
introduced, using specific language to make sure that learners comprehended the
interconnectedness of the national and international picture view of the economy.
This was accomplished via a short Netflix film from Morgan Spurlock, entitled We the
Economy: The Ebola Economy.

https://www.netflix.com/watch/80058032?trackId=14170286&tctx=6,2,a0e9151a-
ed97-4f32-976b-cfc741adae06-237227414. This video has a good preoperational
national tone that allowed students to connect to a larger concrete, then to
formal/abstract ties with a global understanding of economy, beyond the concrete
understanding, of what is happening nationally. At the end of class, students were
asked to list the top three employers in our local county for the next class. This
preoperational to concrete sociocognitive allowed for the following day’s beginning
discussion to center on where students could look to find steady employment in the
local economy. Both classes noted that the largest employers in the county were school districts and healthcare providers, on par with the jobs for 2016 US News and World report, which we had substantiated during our first lesson.

In our discussion we focused on the differences between entry wage, and more skilled wage jobs, within the economy. Through information I gathered in our large group discussion, I chose to focus our attention on what it is like to live a day, both as a top wage earner in America, and as a minimum wage earner in America. We focused our lens through Episode 7, Season 2, of CNN’s original series, Morgan Spurlock Inside Man titled Income Inequality. The discussion, post-video, centered on what it might take for students to unite the career and life goals they have chosen, and align that with the life they would like to live. These are concrete concepts, which, when combined and interwoven with one another, and as relationships start to form between these interrelated concepts, provided for many students to become more aware of specific concrete concepts interacting. Students could now see formal/abstract concepts and could name them with the language used by individuals in groups, small and large. Students had already visually represented these concepts in preoperational drawings, but now, information that we had presented in class in the form of video and discussion, had moved in concrete to formal/abstract thought for a while, but had not yet been seen on paper (Piaget, 1959). Now, students needed to move from concrete and formal/abstract speaking thought, to writing thoughts, which were helpful for students to define in pictures, and enable them to match the concepts for the CBA writing.
I introduced an idea for a future assignment, the Picture Dictionary, to both classes, in order to get them ready for the formal/abstract task of the CBA, and to move student understanding from preoperational to concrete, to a more concrete to formal/abstract understanding, which is the goal of this assignment. I specifically introduced the discussion question, “What concepts have we learned thus far, from the information presented to you, do you think you will need to define prior to writing the CBA?” From that discussion, the answer which 3rd period chose was (1) Borrowing, (2) Lending, (3) Taxes, (4) Income, (5) Budgeting, (6) Credit, (7) Debt, (8) Cash, and (9) Interest. Fifth period chose (1) Borrowing, (2) Lending, (3) Assets, (4) Liability, (5) Budgeting, (6) Credit, (7) Debt, and (8) Cash. Once the class lists were chosen, students physically drew the pictures they had in their brains around these selected concepts. Over the next three to five days, in class, students finished their picture dictionary assignments. Once their 11x17 drawings were completed, we placed the concepts in alphabetic order with labels, to make sure all students understood, in a concrete and formal manner, how their jobs will affect their future lives. Students were instructed to email me three articles related to their chosen job and career goals. Next, a preoperational to concrete assignment allowed for their articles to be collected, for the formal/abstract task of writing You and the Economy CBA. In this writing task, students needed to cite sources, in order to score maximum points on the state rubric.

Days 11 – 15, moving students from concrete to formal/abstract conceptual understanding. This picture dictionary assignment produced a set of drawings that helped move the students’ thinking from preoperational to concrete, and then to formal. As students made deeper connections to their future employment, they
engaged with the concepts in a refined manner. Now, they have added information to their thinking through Piaget’s (1959) accommodation, while working in a group social setting, which Vygotsky (1978) described as an apt motivator for adolescents’ behavior and speech. Peer groups, at this point in their development, are more of an indicator about how their thoughts are expressed, as observed by talking with other peers, in small and large groups. They learn from one another, as much as from the teacher or curriculum, and these, essentially, are the notions as argued by Bruner (1990), Piaget (1959) and Vygotsky (1978) in their seminal works. As they integrate this information, learners are engaging on a more often concrete and formal/abstract sociocognitive thought process, rather than a more preoperational manner of “what can I do to make a living,” and not “what do I have to offer to the world.”

In order to show the students some formal examples of boom and bust economies that reveal the concepts we are defining as we work on our Picture Dictionaries, we watched Last Week Tonight with John Oliver: North Dakota, https://www.youtube.com/watch?v=jYusNNldesc, and discussed (1) Borrowing, (2) Lending, (3) Taxes, (4) Income, (5) Budgeting, as well as, Assets, Liability, and Budgeting. In classroom discussions, students had seen this play out, as defined by the recent Bakken Oil Boom in North Dakota. Furthermore, I presented both classes examples of (6) Credit, (7) Debt, and (8) Cash as exhibited in the video segment titled, “On the Streets of The Greek Financial Crisis,” https://www.youtube.com/watch?v=nDfOFzAKB-w. Both videos gave the students an in-depth look at the real-life implications of concepts that the students chose to explore, in order to help them write their CBAs. The last example I gave, of economic
scenarios carried out in the global economic culture, included the effects on the US and each student. For this they watched The Crisis of Credit Visualized – HD, https://www.youtube.com/watch?v=bx_LWm6_6tA. I emailed the students a detailed list of sources cited for each of our videos, so they would have easy access to citing those sources. This sourcing scaffolded enough learners to achieve easily transposed sources to correctly cite sources. I also spent class time, in the beginning of the unit, on mini-lessons regarding citation of sources, and the expectation of the rubric, to six different class periods, explicitly. Although this was not a focus of the study, citation of sources is covered in the rubric.

A prompt was given to focus the students on writing, and move them into abstract or formal thinking by connecting these larger economic concepts, in order to write a CBA. The prompt was:

How will your career choices effect the local, national and, or, global economy with examples, claims and evidence. Furthermore, analyze the capitalistic, economic system throughout the global economy, how this analyses affects my choices. Examples need to be given. Use SEE statement sentence, and paragraph writing, make claims, and cite them with evidence.

Students were given twenty silent minutes to write this essay. Students were comfortable with Statement Evidence and Evaluation (SEE) statements taught in our English and Social Studies Departments. They offered students a reminder that each argument statement they make, in an essay or presentation, must have accompanying evidence, which it draws from, and an evaluation of the evidence by the writer, in order for the writer to evaluate the evidence. That evidence is then presented in a
manner that is logical to the reader, and which will be recorded ultimately on their CBAs.

Cartooning was the last intervention prior to the CBA due date. This process asked students to use 11x17 paper to draw their concepts, based on the ideas presented during the You and the Economy CBA. I spent about twenty minutes drawing my own cartoon, which I prepared, and explained as I drew. This process allows the students to see how using cartooning can assist them, as a prewriting technique, or visual organizer, for their CBA writing, which is due as the final product. This prompt was completed by the respondents; “with all you have learned in the last few weeks about You and the Economy CBA, draw yourself into the current economy.” Students were given twenty minutes to complete this in class. The drawings elicited feedback from other students as well as the researcher, and informed the treatment group of their writings, which were to be scored by the You and the Economy CBA Rubric. This assignment was given on a Friday, and the You and the Economy CBA was handed in on the following Monday.

**Data Source One—Analyzing the Daily PowerPoint Agendas in the Teacher Journal**

**Week 1, Day 1: Preoperational to Concrete.** Question 1 asks, what is the nature of the brain-based intervention? The first intervention was watching CNN Student News, a formal operational task designed to highlight current event coverage, media, and special events, as well as to elicit questions, comments, and concerns about CWP.

I next introduced the video Best Jobs of 2016. This video was specifically used to illicit preoperational responses in students about what they personally wanted to do
with their lives, and to capture response for the Draw Yourself into the Economy (DYE). This video intervention illustrated specific concrete examples students could adopt as they contemplated various fields, and specifically jobs: Medical, Orthodontist, Nurse, and a selected technology field that might entice them to spark an interest for their cartooning. Making the decision to show this video allowed students to absorb images, and to activate images that formed the basis of their concepts, so they could begin their drawings, once this short, six-minute video was completed. I noted in my journal that most of the student reactions to the video, Best of Jobs 2016, were positive, and there were many that chose careers in fields such as nursing, education, and technology, as we will see later in this chapter. I noted in the teacher journal that comments students made during discussion illustrated that the jobs, or in this case claims students begin to make, are preoperational. The ultimate career goal they might have already known, but they were not making drawings about how to achieve those goals, just jumping to the end result. The futures they chose are being influenced by the information provided, as well as their personal information. All but one of the respondents chose a job within the professions presented during this video. Student RE ultimately chose the hospitality industry.

Progression from this video to drawing prompted students, by priming them for activities that lead to brain-based strategies, wherein students were actively engaged in creating meaning via the abstract economy video, as well as through their cartoons. Peer to peer conversations, as noted in my journal on the DYE, were enhanced by allowing students that have shown the ability to work well with the people they are near, and with whom they will be able to share their ideas further, to better understand
their thinking as they are conversing, and explaining their drawing to those students around them.

In order to assure that learners are refining their concepts with help from me, and other students around them, and that their discussions are on task, I scaffold learners by going table to table, holding informal interviews. From glancing at the cartoons, I note from my journal that students were representing universal symbols of wealth, employment, expenses, and opportunities of interest, and those areas they would like to engage with for their potential careers. I further noted in my journal, and later corroborated by the actual cartoons, that students had made direct ties to themselves. Through considering the economic situations of their families, the genesis of preoperational thought is evidenced in their drawings. Seeing careers, listing careers, and drawing careers, activates all parts of a student’s primary (brain) and tertiary (body) nervous system. These are deep connections to material that students will need out in the world, on the job hunt. Once students draw these symbolic understandings, students then can start to describe those understandings later in words and, as we will see in the *You and the Economy* CBA, the results showed a gain.

As I conducted my informal interviews, I noted in my journal that students were representing universal symbols of wealth, employment, expenses, opportunities of interest, what they would like to engage in as their careers. Those representations had direct ties to themselves, and their families' economic situations; this will be discussed further in the student work section, in data sources four and six. My conversations with students were simply about how to get started. As I noted in my assessment of the drawings trends as a whole, all had some sort of very preoperational, conceptual
representation of themselves in the center, surrounded and connected to others, not in any explained way, but the relationships and people, places, and things, are all present. This suggests that, as a group, there was a preoperational grasp of the material.

In my email communications with students as prescribed in the agenda, I found that the overwhelming majority chose careers that also were tied to aptitudes they had recognized in themselves, and were using as evidence from their lives, to add to the claims of what they wanted to do professionally, upon graduation. I hoped this preoperational task would allow learners to use the internet to connect to their own interests, in order to create student-based decision making, which is so important to moving concrete thinkers to formal/abstract thinking. Many students, because of the close proximity of their graduations, as we will see in data source six, had many ideas about both small and large local companies that they were looking into for employment. I asked for this email, so that those that were already moving along to the preoperational ties would be able to make more connections that could be built in later, such as finding articles for the List of Sources cited, which will be part of putting together the CBA, towards the end of the unit. I closed with asking for the articles from those that were interested in taking the next step.

In hindsight, I recognize that a more preoperational intervention would have been to start class with a preoperational prompt that began by asking students to list the items they had in their pockets. Secondly, I could have asked them to respond to the who, what, when, where, and why, of the items, in order to explain them as personal or preoperational connections to the learner, in both the concrete (how it affects those around the learner) and the formal/abstract (how those concrete concepts
interact to form the ideal systemized definitions society places on persons, places, and things, in the form of language).

**Week 1, Day 2: Preoperational to Concrete.** I started with *CNN Student News*. I introduced DYE, as a continuation of the discussion we had started as a class yesterday, to build towards finishing our CBA. Engaging as many people as possible in this process, at many different levels, dictates differentiated learning for those that will move through material, and make connections. The three tasks of cartooning, listing the jobs students are interested in, as well as where they could work, allowed them to assemble these undertakings at their own pace. I set those up because adolescent brains need novelty, and they need to transition from novelty that relates in context; these three assignments give them context, in a time frame that corresponds to age 18; their ability to pay attention can be measured in minutes, to a one-to-one ratio. Baars and Gage (2010) suggest that 18 year-olds pay attention for 18 minutes before the brain seeks the novelty of a new attention device; 16 year-olds can engage for an average of 16 minutes, and so on.

I broke the DYE assignment over a number of days, to differentiate between them, as well as to give extra time, and avenues through the different assignments above, to be engaged in the process. They are also focused with their chosen peers, as they have been working in small groups, getting consistent feedback on their processing of information, while having conversations (Journal 5) with learners around them, and completing tasks that allow the learners to center on the task of choosing a career which they might be interested in pursuing. The information I will give them is an overview of the economy, and introduces some of the fundamental
structures of the economy since 2008. I wanted to use this video to give students a formal structure as they are drawing, so as to be able to encounter some real-world experiences.

As I note in my Journal, most students are working with the material on a preoperational basis; I need to activate thinking at a higher level, in order to *raise it*. This is what the videos, and my talking time to the large group, small group, and individuals, provide. They give visual context to the auditory stories that I highlight, and personalize that context by doing the DYE. As the DYE is being completed, and the video *The Economy* is shown, students make those real-world connections to their own individual worlds. Many conversations with students reveal misconceptions that I clear up in the conversations. I scaffold learners by going table-to-table, holding informal interviews. Students were representing universal symbols of wealth, employment, expenses, opportunities of interest, and what they would like to engage in as their careers. In the Video Observations, the student interviews confirm that students had direct ties to themselves, and their families' economic situations. The genesis of formal thought is evidenced in their drawings.

The six respondents’ drawings indicated a preoperational to concrete understanding of the formal concepts of their drawings, as they could not explain the process required for them to achieve these careers when queried while they were drawing. RE, a student I interviewed, indicated he was going into his family business, and planned to open a restaurant. I asked him about his drawing, and his reply basically described his drawing, as I relayed on my study notes at the time. I wrote in his exact response in my study notes:
People buy wants/needs. Working me buying things pays for other things employs others. Picture of a money symbol in the middle. Stick Figure with me and Guap stands for money. Name of the bar and grill his family owns. I want to go to college for business and manage my parent’s restaurant and hopefully eventually run it. I also want a good education so I can take over the business so I can run my own business. Graduate. Work until winter. Go to Clark and work for 2 years. Transfer to a 4-year. Finish my degree manage with my parents. Life Goals Travel the world do everything I’ve always wanted live a good life (sic).

We finish with viewing The Economy, a production created by Ray Dahlio that defines the economy as large sectors colliding into one another, as well as the market composition, and how those elements relate to the larger economic picture. It is a good summation of macroeconomics, so that the students can have a formal concept broken down into its constituent parts, in order to understand the economy better. It also has great visuals, and a well-documented message that has resonated in the market place in the form of Ray Dahlio, 40-year conqueror of cyclical U.S. economy. This video provides concrete examples that students can access, as well as the larger picture that is an abstract or formal picture of the economy, that Ray aptly describes, breaks down, and illustrates.

**Week 1, Day 3: Preoperational to Concrete.** Starting with CNN Student News provides an easily accessible delivery of formal/abstract material, with concrete, developmentally appropriate material, so adolescents can build upon their knowledge, and acquire new information based on their refined thinking; new material can then integrate with old, to create synthesis. With the three tasks ongoing, by the middle of
the first week, students' cartooning is refined, their conversations with those around them, myself, CNN, and their daily interactions are undergoing modification, and their thoughts are manifested through their drawings. Within the group, many people have started over, or redesigned their drawings. I take us back to the Ray Dahlio video, and make connections to what we are doing in our drawings, to make sure students do not have any unanswered questions, comments, or concerns. I asked them to select the three most important details from Ray’s video from yesterday, and share that with their partners next to them. We share those answers and discussions that recap the video's message. This activity facilitates discussion as an access point, as well as refines the thinking for those that have been following right along and commenting, as well as leading the understanding of the material in class.

As we wrap up our drawings for the day and transition into Ray Dahlio’s *The Economy*, discussion turns towards some of the fears students have about emerging into this economy. I share that these are human fears that we all recognize as part of the human condition. We finish with accruing more information from the video about how the different economic sectors come together, and form this large economy. To get maximum participation and multiple perspectives, I have placed the desks in the room to T-formation. Four students sit at the horizontal line and four students sit on the vertical line of the T, forming a large table group of eight. This is an optimal table set up, affording students the opportunity to experience as many chances as possible to see and hear how others are engaging in the work. Encouraging discussion as students work is key to their acquisition of meaning, as they bounce ideas off one another, to widen the scope of their own and others' worlds. As we move through the
preoperational learning, and presenting of information phase, we can then to progress to concrete. During the preoperational learning progression, the students had a chance, daily, to apply and practice their growing knowledge of concepts with the other students around them, when they specifically present what they have drawn, and explain that, first to the table partner next to them, then, to the person across the table from them, and last, to another person at a connecting table.

Week 1, Days 3 and 4: Preoperational to Concrete. CNN Student News brought out economic features in their coverage. I introduced these to the class, and rehashed the discussion from yesterday so as to connect the drawing work we will do today, and to reinforce that students are staying on topic, as well as a review of the agenda for each day. Also, on the board, projected through my laptop, is the agenda, what the class will cover in the time the class will meet. Students can refer to the board at any time, both to know, and get redirected towards, the goal (see Attachment O for the Daily Agendas). This serves as an attention-directing device, and also as a structural piece, which gives many of my students some much-needed constancy in the learning environment, so they can settle and go beyond a simple thought of surviving, to complex thoughts of thriving and thinking.

Days three and four are a continuation, as well as day 5, in order to provide information in a coherent and cohesive manner, and to make sure that there is a basis of understanding for the whole class. A trend emerges in the study that there are holding days on Wednesdays and Thursdays, when I can break up the material into pieces, chunking, about 15-20 minutes at a time, so that student attention is best served. This system of content delivery makes the use of several days to complete
multiple parts of concrete nature, and refine them, and combine them to form more complex interconnected knowledge, such as the natural progression which Piaget and Vygotsky found works for formal, or abstract learning thought. The design of the curriculum allows for the knowledge of the students to unfold, so they retain and manipulate the information, from the abstract concept of an object, into creating a concept and connecting it abstractly to the world, and then describing it in words, after seeing it as an image. After drawing time, we rehash the concepts we are acquiring through Ray Dahio’s *The Economy*. We will finish this video today and discuss the ramifications for Friday, tomorrow.

**Week 1, Day 5: Preoperational to Concrete.** CNN Student News highlights formal, operational, current events in order to build media awareness, and also current event awareness for my students. The DYE assignment is highlighted for those that did not complete it, as a way to allow as many students on board as possible, as well as to cover the topic. If some have not grasped the assignment, they might have one more contact point, before we move from presenting the preoperational material for the first week. Students had the final 15 minutes to complete the drawings with the information about the companies they could work for, in the industries in which they might be interested, in their futures.

My preoperational-based I story unfolds as the lesson unfolds. I want to show students, and describe how I build an argument, making claims and providing evidence to back those claims. By informing them further of an I story about why I ended up in education, they will have a personal reference to themselves, in order to better understand in a concrete manner, another person’s story, to which they can
relate since they know me. Each week I tell more and more of that story culminating in my drawing demonstration of career choices and why I chose them, based on the economy I was facing when I was making decisions about my career.

Videos gave students concrete examples. Every day I reassert that, and give an update to remind us where we were. I end with questions, comments, or concerns and have students share with their partners, then table groups, and then large groups, to inform everyone of the examples that we can use as evidence for how the economy works at large. I am showing students, and explaining as I go along, that this is evidence that I would cite if I were asked the question, what I would do to earn a living. My I story evolved, as the presentation evolved, into a concrete conceptual presentation of information that must have a preoperational connection to the learner. Student stories start to evolve as they make deep structural language connections to their families, communities and the understanding therein (Journal 10).

Inside Man represented concrete operational definitions. A wealthy person was followed in daily life, and then Spurlock's cameras followed a wage earner living through daily issues, to see what each goes through during a month period’s time. Inside Man allows students to connect at a preoperational to concrete level, and shows some glimpses of formal/abstract thought about the income distribution in America. The job of service wage earner represents most of my class. The wealthy ideal that Inside Man explains is recognizable for its conspicuous consumption and lavishness. The discussions around the film in class highlight that students did not identify with that lifestyle as much as the wage earners. Those that completed the cartooning moved to List the Top three employers assignment. They noted that the employers were
primarily government agencies, which was a great discussion point, and moved this conversation from a concrete world to one of nuance and abstractions. We continued getting claims and evidence for the economy, and how the rich and the poor are living completely different lives. This allows students to make personal connections to their levels of income in order to identify how life might turn out for them, based on the amount of money they can accumulate. This week the focus is on moving students from concrete to formal.

Observer 2 (Appendix C Observer Data Collection Sheet) marked SE1 and SE3 and wrote, “Teacher allows students to present their writing ideas in multiple formats. One student shows his writing on paper, while another on his iPad.” For an example of SE5, there is a note from observer 3 that says, “Students will share their writing with their partners.” Another example of SE5 is indicated on another observation, observer 1, “Teacher reviews project expectations final before weekend. Cartoon self into job living in world explains chunking information about the project to parts of panels using visuals. Teacher begins to model process to class. Students give feedback on drawing and discussion.” P3 was found in observation 1, observer one, noting, “Teacher has information of agenda/project, due dates, etc. for all to see.”

Unfortunately, the initial question for the drawing prompt was a formal question. Draw yourself into the current economy is the prompt that I assigned students to complete in class, on an 11x17 piece of paper. While the questions to answer on the backside of the 11X17 were preoperational, and the students answered them as such on the back of the DYE assignment, the drawing prompt was a formal question. This was a mistake on my part which influenced the study, which then reduced their ability
to make connections to the material, and as we will see in the writing part, contributed to the hollow phrases and borrowed language in both of these learners' final CBA. Four of the respondents are neuro-typical and their drawings, in these cases, are preoperational as well. This makes sense, since the question was to solicit a preoperational response, so that the students could directly tie to the material. A better way to do this would be to ask each of the students to make a list of the items they brought to class, and then have them draw the connections of who, what, when, where, and why, in cartoon style, so that the students could see their personal connections to the economy. This explains the inability of these four neuro-typical learners to reach the formal level, and continue to stay at the concrete, thereby failing to make the larger connections in their papers. We will see this occur when we look at the data to answer the second question.

Week 2, Day 1: Concrete to Formal/Abstract. CNN Student News is tied in from the world to the classroom for a formal experience. As the first week of the study, and moving from preoperational to concrete, came to an end and the next week began, I reintroduced the topic, and had the students reengage with those around them to reexamine their conversations from Friday, and to share, in the large group, some examples. (Journal, 7). Once engaged at the preoperational level, talk about your drawing with your partner, we want to get their thinking back up quickly and as we report to the larger group, I am checking for understanding from those who are behind in the assignment, and working to stay connected to the material through the large group discussion—increasing conceptual access points for students to enter into the learning at any time—flowing into a concrete example of connecting to the economy.
From Morgan Spurlock’s *Inside Man* video information, their drawings, discussions, and sharing their personal articles and examples of companies they can work with, a combination of classroom tasks are coalescing into combining preoperational tasks, so they integrate to form concrete steps that the students will then merge from concrete to abstract or formal thought, in the same manner.

Refined thinking from the videos *Inside Man* and *The Economy*, acquired by students through the repeated task of combing and manipulating preoperational material, led to concrete understanding and manipulation with the sources I chose, and which provided context for students, to help them create deep structural meaning through exposing them to real world examples. While discussing this, and having context provided by me, students become active participants in acquiring language through as many access points as possible. We are creating visual, kinesthetic, and auditory streams of information, so they can process that information into abstract or formal thought, as carried out by completing the assignments, especially the CBA.

According to cognitive psychology-based researchers, in order for students to acquire language and thus inform and raise their thinking, they must have multiple opportunities to manipulate and work with the information at the preoperational level, in order to build towards the concrete level. Each level requires the multiple manipulations, before the learner can piece multiple concepts together, in order to move on to the next level of understanding. I must scaffold them as their teacher, as their knowledge unfolds, and as their knowledge is refined. Ultimately this process allows students to create meaning through connections to their lives. Getting together in their informal discussions, and rehashing the information, allows them to reconnect
after the weekend. Processing time in groups, as well as work, helps facilitate the connections for this new information.

Last item of the day was to solicit from the classes, after their table discussions, their thoughts about the top three employers in Clark County. We talked about how a lack of economic diversity might be a reason Clark County was lagging behind the economic downturn of 2008. Also, as I noted in my journal, the discussion became more personal, and many people saw the connections to the original video about the top jobs being in the medical field. I solicited responses from the members of the class that have completed the assignment. For those that have completed, connections are solidified. For those that did not complete, I ascertained whether they had a foothold into the concepts, and could connect with them through listening to others, and then discuss these concepts to make further student connections to the material I am presenting.

**Week 2, Day 2: Concrete to Formal.** *CNN Student News* offered a formal glimpse into news and media coverage. I have been priming them each day during this unit. As I introduce the class to the examples they are seeing, they are discussing how the examples impact their lives and the lives of those around them, deepening their language and understanding, every time they speak with each other in the classroom, regarding the material they are covering. As I solicit their input about what they need to define for the upcoming brain-based assignment, Picture Dictionary, their responses let me know about the impact of the previous exercises.

In this assignment, students drew the concepts we defined on a large 11x17 sheet of paper. This large paper was folded to make six panels, to help foster an activity that
is visual, auditory, and kinesthetic, and that allows students to understand economic concepts in order to help in choosing their careers, and in preparing to write their CBAs. As we discuss the assignment, the drawing will allow for discussion, and for lots of people to see the information they have already acquired on each of the concepts we identified. Research suggests adolescent brains find this inquiry method of presenting the information productive. When students manipulate ideas from auditory processing centers in the brain to their visual processing centers, and then overlap that with a kinesthetic activity, it allows for the movement of all students to a common task. Participation is high in activities that activate those three systems of the brain simultaneously. These learning strategies developed with cognitive psychology foundations suggest that cartooning adds information into concepts students already have, and allows them to access the concepts visually, acoustically, and kinesthetically. These strategies allow the students new ways to organize information, thus deepening their understanding. As students are discussing their information, hearing multiple perspectives in the room, their knowledge is expanded. Each time they share, and someone else shares, and they listen, concepts are re-identified and coded, processed, and rehearsed, over and over, so the student can acquire meaning through peer to peer interaction, small group interaction, and large to whole group interactions, so all that are present can take part in the classroom learning tasks.

The concepts that were introduced, and agreed upon, to cartoon for the Picture Dictionary assignment are Taxes, Income, Interest, Borrowing, Lending, Cash, Debt, Credit, Assets, Liability, and Budgeting. Unfortunately, I unintentionally engaged learners at a formal level rather than a preoperational level. In doing this, they failed to
make the preoperational, and concrete, to formal/abstract connections they needed to clean up their language to a formal/abstract ability, as we will see in the answers to question two, towards the second half of this chapter. This is another issue with not introducing the students directly to how the economy affects their pocketbooks.

**Week 2, Day 3: Concrete to Formal.** *CNN Student News* introduced formal operational media and events coverage. I introduce and tell more of my I story, and highlight the economy, and what is going on in the news, and relate that to let them know they can use examples, such as the ones I have given them. My I story gets further refined around each of the definitions, as I reintroduce them to the students who have been gone over the weekend. I ask them to rehash the words in think, pair, share around the question, what are the 3 most important of the list of six concepts each class has created. After they have listed, thought, and written their answers, each student shares his or her answer, and then groups share until we get a large group share so everyone is talking about the same examples.

As I worked to scaffold all learners in the room through engaging the interview questions, the main goal this day was to get as much drawing and discussion time in their small groups, and for me to communicate with those that need extra help personally, and to encourage, and give informative feedback to those closely following the lesson. As students get to know their concepts fully, they will be able to use them over time, and to understand how people have lived before, and will in the future. The cartooning time given for this day was twenty minutes. During the drawing time, I worked to connect and scaffold each student, moving from table to table, talking to students. Video evidence as well as observation shows that this happened. The main
goal this day was to allow as much drawing and discussion time in their small groups as possible, and for me to hit those that needed extra help personally, and to encourage and give informative feedback to those closely following the lesson. In the Video Observations, the conversations I noted having revolved around where to place the items. Thus, the universal symbols of human interaction and money are coming into focus.

Observation 1 noted that, “Teacher reviews the specifics of the lesson content and provides an example of how it works within the lesson context. Teacher reviews students' writing and provides examples about how different content relates to different career trajectories.” This same observer noted further, “Teacher reviews content material and provides examples of how it relates to their present task.” Observer 4 notes,

Teacher puts Picture Dictionary assignment on the board. Students were to define words by drawing a picture of different words/concepts. Students are having a side conversation; teacher regroups the class. Teacher explains the assignment. Teacher, ‘the context is that you can picture these concepts, you will be able to write about them better later.’

As the observers noted, scaffolding, as I have indicated prior and further along in this chapter, is substantiated from this observation. In looking at the video, this evidence is corroborated in my teacher journal, as well as in the daily journal, the study happened as written. The interventions are documented in multiple places and are described, analyzed, and featured, throughout this chapter.
We finished with a concrete example of boom and bust economic cycles that students are faced with when deciding in which industry to work. We covered the Bakken Oil through *Last Week Tonight with John Oliver: North Dakota*. I introduced the terms as in the deregulated economy where natural resources-based jobs may be great lures for people through job descriptions, but that there might be some perilous conditions, that workers engage in on the job, that could prove deadly or disastrous to individuals and also create environmental devastation to a local area. This is a concrete example through formal storytelling. I also weave this into how to connect to sources they will need for this CBA, allowing the whole of the project to unfold as the assignments get more in-depth, and the concrete examples compound to form abstract thought. I scaffold their understanding by connecting the larger project to the pieces we are doing as a group, to help us accomplish the formal abstract task of completing the CBA. We finished with the video to conclude and discuss the next day.

**Week 2, Day 4: Concrete to Formal.** This is Thursday, and as the study goes on, I find myself allowing for Wednesdays and Thursdays to flow into workdays on DYE, and then now PD assignments, respectively, so that students have adequate time to finish this portion of the project, as well as discuss their progress with those around them. Presented with formal operational video information, cartooning, and my availability to work the room, I make sure to converse as well as ask guiding questions. The breaks in between days allow for us to have talking points to go back to, and discuss in partners, and small groups and then large, to make sure to give plenty of access points for all learners, and to reassess that information in order to strengthen the neural connectivity in all learners.
I showed CNN Student News for access to the day’s events as well as media practice. CNN Student News is engaging students at the concrete and formal level. I find that when I make sure to make connections to what we are learning, the students have an easier time relating that information to themselves, which is preoperational, and may also allow those learners to better connect to the concepts presented, in getting the CBA completed. I make those economic connections for the students, and asked for questions, comments, or concerns. A good discussion covering the Greek Financial crisis was noted, which we will be using as an example of world economy on the brink of collapse.

The day is repeated with quick share outs, and having each student turn to a different shoulder partner to illicit ideas about how to incorporate diverse ideas regarding drawings, and how people might have different interpretations of similar ideas, so I asked they discuss their drawings before we will begin our last drawing time tomorrow. Today, they received less drawing time so as to show them urgency, and that the due date was fast approaching. Another reason I chose to do this was to engage some of the learners that were still lagging behind. At this point a few people in each class had already turned this assignment in and I had given them feedback. I could gather from the pace of some class members' work that the unit needed to come to a close.

After the drawing time, I asked students to share with different person than they already shared with earlier in the day, if they could see themselves working in the Bakken Oils fields, and then we began the video after a short five-minute
conversation. I got the movie up, then asked if they had heard from both partners, after which the video ended, as did the class shortly thereafter.

Picture Dictionary is due today so I can give them feedback by Friday when they will discuss their drawing with their partners; they will be completed by this time. Three class days for each assignment allows opportunities to build the assignment, together as a class, while working towards the same goal. This allows for participate at any point and for those that are participating, it builds on the trajectory of either preoperational to concrete, concrete to formal and formal/abstract thought. Working through problems in this manner allows for maximum consensus and group discussion for learning the concepts and putting them into writing, as they will do on the backside of this assignment. Writing to the picture after it's drawn is the final step in the cartooning process.

**Week 2, Day 5: Concrete to Formal.** I show *CNN Student News*, and we discuss all the emails I have been sending the class for examples that they could use, and cite in their CBAs, as well as where they can also access them. It turns out that in their CBAs they used, and cited, all the articles I sent, as well as many others they had found on their own. Students did score well overall in their CBAs', citing sources in their papers as well as in their lists of sources cited. As this project is ongoing, so are the resources I have sent to them, in the form of emails of news articles, that will help them to complete the CBA.

I switched gears to discuss the documentary video *North Dakota*. At this point I want students to see the attractions at the Bakken oil field. All generations have their highly dangerous occupations, which result in higher than average payment options to
start, this can be alluring for recent high school grads. I make the point to choose your career wisely, as dangerous jobs do exist. The Bakken Oil field in North Dakota has killed and injured many workers. I show this concrete example of an industry that is pretty standard in America. I use formal historical storytelling with injected humor to allow students to follow the train of thought, as well as think further about their careers and what they might look for, other than just concrete ideals, such as how much money I can make in any given job. The formal application of knowledge in this case is students intrinsically choosing the career that best suits their interests. Students, through the discussion, further their language ability by now being able to reaffirm or change their thinking, as they interact with others discussing the different sources, my material, their lives, the world, and form ideas that enter into their schema, to inform them of their world and their place in it. While none of the CBAs specifically mention any of the examples, these examples are integral into allowing students to see what jobs and options they will, and could, be faced with in the near future.

The learners refine their drawings. I have scaffolded their learning by including written instruction on the students’ work. I then hand back the work so that students acquire multiple questions and feedback from me. I want to make sure to put the assignment into context. We completed this assignment so that the concepts we needed to know, have now been manipulated by the students in drawing and writing, and their thinking has changed through this experience. Once they now put many of these concepts together, they start to build concrete knowledge into formal or abstract knowledge. As they manipulate the knowledge, they are combining the concrete meanings to produce semantic relationships, and strengthening their understanding of
the material to a more formal or abstract manner, in which they can manipulate and see change through the drawings and writing.

For the rest of class, about 15 minutes, I scaffold the class learning by drawing my versions of each of the concepts, and then explain the connections that many of the students made in their drawings. This engages those that have completed their drawings, and have received feedback on them, so they can make the connections. The drawing also engages those that have not turned in the work, and those that are still trying to connect to the assignment. As I drew, I made sure to describe the concrete to formal/abstract ideas in each of the PDs they have cartooned. Students' attention is directed to the learning, and all are involved in the process that allows for multiple perspectives. As I draw, much of the conversation revolves around the students helping me draw these concepts, as well as my guiding the connections, so that they can see how to take concrete concepts, and combine them with others to create abstract or formal thought. They get to see the example from me about how to do the assignment, and that gives them another access point. We close the week in formal/abstract fashion to get ready for the next week, when we will then begin to put their pictures into writing or abstract thought.

The information at the end of this week scaffolds towards the timed, 20-minute free write students will be completing on the coming Monday. This is a formal task that will allow students to complete the next two formal tasks, and check to see if they are on the track to complete the CBA in a positive manner, and for me to identify those that will need intervention. The final task, prior to the CBA, is to cartoon the CBA prompt, and to write to the CBA prompt that is to be turned in the following
week. There will be plenty of time for students to share about their drawing with partners, and in small and large groups, to form language connections and refine their thinking next week. As they refine their thinking by engaging with others in conversations about their projects, they are adding concrete meaning, and refining that thought further to form formal or abstract thought. As students work on these assignments, it escalates their formal thinking, as the thinking ultimately required is abstract. Students have to talk, and consider, and manipulate scenarios they have been presented with during class in their own heads, and share those thoughts with others, in order to be able to formally engage with the world.

**Week 3, Day 1, Formal/Abstract Operational.** I open this week, which is formal/abstract, with *CNN Student News* and students spend the day answering the prompt “Describe how your career choices affect the local, national, and or global economy and include examples, claims, and evidence. Furthermore, analyze how the capitalistic economic system throughout the global economy will affect your choices. Examples need to be given. Use SEE statement sentence and paragraph writing. Make claims and cite them with evidence.” Students were given twenty silent minutes to write this essay. Students are comfortable with Statement Evidence, and Evaluation (SEE) statements taught in our English and Social Studies Departments. They offer students a reminder that each statement they make in an argument, in an essay or presentation, must have accompanying evidence which it draws from, and an evaluation of the evidence by the writer, in order that the writer be able to evaluate the evidence presented in a manner that is logical to the reader, and will be recorded ultimately on their CBAs.
Assignment 3 is a 20-minute free write on CBA question results. Of the 6 respondents, all composed a general outline of what they wrote, and turned it in for the final paper. The analysis of this writing was created as I read and re-read this section, before I read *You and the Economy* CBA essays, and then after, to confirm the connections for each of the writers from his or her free write, to the essay discussed in more depth later in this chapter. This intervention clearly allowed students to refine and practice their essays, and get it all in writing, before they draw it in pictures tomorrow and the next day, and before turning the typed essays on the following Monday.

**Week 3, Day 2, Formal/Abstract Operational.** I opened this day with the *CNN Student News* for formal discussion and response to the day’s current events. This day I am to draw my whole I story to scaffold the respondents’ drawings. I start with a reminder of what we are doing, and then continue my I story. I tell the students I will be drawing my own journey toward choosing a career, and giving justification in the economy that I faced when I was their age, and made the same journey to find my occupation. As I draw, I notice all eyes are on me, including my evaluator who documented this lesson as well. Throughout the next twenty minutes, I began by drawing a picture of myself along the journey of my life from birth, my parents and family, my schooling, interests that led me to find my calling of teaching, and the milestones that changed my mind, and confirmed over the years what I wanted, as well as the economic situations I was faced with, including the recession of 2008, as a backdrop to reinforce the boom and bust nature of the economy. I want to communicate a sense of how to draw these images, tie them together as concepts, and,
along the way, describe my thinking and evaluations, so they can see how to draw themselves into their own story, connect to the world events that are transpiring, and find a career they can see themselves in as they drew themselves into the world they created.

I hand out the 11x17 sheets of paper. Cartooning was the last intervention prior to the CBA due date. This process asked students to draw out their concepts based on the ideas presented during the You and the Economy CBA. The students completed the assignment based on the prompt, “with all you have learned in the last few weeks about You and the Economy CBA, draw yourself into the current economy.” Students were given the remaining time—12 minutes—to complete their drawings in class, with the proviso that it was to be completed and used to inform their writing over the weekend, as they were preparing for their CBAs on Monday.

Week 3, Day 3, Formal/Abstract Operational. Data from these two days must be combined into a single entry, as the days were half days due to a school function. Both days were started with CNN Student News, and the same primer to get students to complete their drawings as well as the CBA. Each day I had students go over the requirements, and encouraged discussions about how students were engaging with their CBAs, as well as completing the technical requirements of the rubric, such as reminding students about the expectations as well as the List of Sources Cited Document. Each period, I made a point to go over that, and to ask and answer questions.

For both days the remainder of the time was speaking to students, answering questions, and making conversation with each of the learners that were completing
their drawings during class. When the class had worked for 12 minutes each day, I concluded with asking the students to share their cartoons with their partners, and asked that they describe what is happening in their drawings. This helps to build their conceptual framework for a deeper understanding as the refining and discussing of their concepts with me, as well as their peers, is happening in the classroom.

**Week 3, Day 4, Formal/Abstract Operational.** It is the last day of the study. We start the day with *CNN Student News* to get a formal recap of the day. I introduce an overview of the unit, how we progressed to where we are, and that this will be the last cartooning day. This will also be the last day to get feedback from me before turning in the CBA on Monday.

Most of the day consists of students putting final touches on drawings, and their CBAs, and conferences with students about their projects. Often the discussions centered on putting together the List of Sources Cited. Additionally, I needed to make sure that students who needed help getting their work in in proper order, to achieve completion of the CBA, were being advised. As many of the respondents had completed the formal/abstract task already, much of my time was spent getting others up to speed.

The conclusion of the day was a conclusion to the project. I offered a big thanks to all that submitted, and will submit, and a reminder as to why we are working towards the goal of the CBA—to be better thinkers by communicating our knowledge and understanding about a formal/abstract project, the CBA.
Summary for Question 1

1. As brain-based learning strategies are being implemented in real time, what is the nature of the process of using brain-based interventions? In documenting the brain-based interventions, what decision-making factors are considered when designing the unit of instruction?

As the curriculum unfolded, my I story went from preoperational, to concrete, to formal. My Questioning methods went from knowledge and level one, to synthesis and evaluation at the top level. In scaffolding the student respondents, I used many methods: think/write/pair/share, discussion, cartooning, video based information, articles, and formal writing, to assess their sociocognitive levels based on a state CBA rubric. While the decision-making factors were previously documented in detail, in this chapter, through the teacher journal, video recording, and administrative interviews, one problem did appear. In my application of the preoperational section of my procedures, I asked students a formal question for the Draw Yourself in the Economy assignment. This potentially contributed to six respondents not being raised to scores at 4/4 in the CBA grading rubric. I will discuss this further as the chapter unfolds.

Data Source Two—Student Assignments

Cartooning Assignment 1 – Draw Yourself into the Economy (DYE). For the assignment Draw Yourself into the Economy (DYE), I first went over each of the drawings and recorded what students wrote and drew. I then went over each drawing a second time, looking for themes to emerge. One theme that emerged during the Draw Yourself in the Economy was that students picked safe careers that were based on
their interests and abilities, such as nurse, teacher, graphic designer, lawyer, restaurant owner, automotive tech, doctor, and television writer.

A specific example for Draw Yourself in the Economy, a description of KG’s cartoon is as follows: Drawing of her in the middle surrounded by lines drawn to words, Bills, bills, bills, gas prices, paying for schooling, hard getting a job, minimum wage $9.47. Taxes. Career goals always move up become a manager of a decent company. Life goals be successful, live a happy life, live in a decent home, take care of my family. Steps graduate HS, get a better paying job, find my own place. A theme emerges in the drawings, formal operational ideas represented, with no clear ties to their person. This certainly could be a symptom of not being able to connect with their preoperational thought.

As I draw in more detail, I am answering the second research question in regards to findings in the writings of the six respondents. Ultimately, because I did not facilitate their cartooning interventions correctly, the participants may have missed these preoperational connections that build into concrete, and then formal/abstract after they are refined. While I refined them in plentiful ways, the cartooning left much to be desired, in the way of true preoperational sociocognitive building, that would have required a personal question such as describe what you have in your pockets, and then made the who, what, when, where, how, and why, connections to each of their items in order to tie them to the global economy. Once students made connections from their items to the world and back, their thoughts are refined enough to begin to make preoperational understanding. Building directly upon living experience to bring to bear to the learning environment, the language, students’ use in context during table
discussions with the other learners around them, allows them to collectively grasp formal thought. Once that happens, the writing clears up. There are fewer, or no hollow phrases, and borrowed phrases become obsolete. From the results of the CBAs most of the students need ample practice and glimpses of formal/abstract thought repeatedly throughout their formative brain development years, until they reach 23-25.

Once I described each drawing the best I could, I then used the definition in chapter 1 for the preoperational stage, concrete developmental stage based on Piaget and discussed in detail in chapter 2. An example of concrete to formal thought that was found in the study from RE:

Symbols drawn are preoperational and show concrete understanding of the topics depicted, movement within the drawings as well as the many concrete concepts that are shown interacting indicate a beginning of formal understanding of the economy. His career goals show a formal ability to plan into the future, his abilities are marked and he connects to this industry directly. Formal concepts are present in the drawings, and the connections to the economy and him.

I described JV’s drawing as a list of items he wants, with pictures, money, house, car, computer, phone, entertainment. He does not have those now, he plans to be a programmer, make money, and take that to the bank and then live off his proceeds. He writes ‘Our economy is full of money and goods but people lose sight of how money really works its paper exchange for goods and paper can make paper.’ In analysis of this drawing I noted, Preoperational (things I want) to concrete, (I can’t have those things unless I steal, that is against the law and will incur the police, banks don’t loan to him because he has no money) understanding shown in drawings. Lots of
symbolic play and manipulating the symbols for representing concepts, shows a preoperational understanding of how these concepts interact with him (sic). Concrete examples included in the Draw Yourself into the Economy are as follows:

JC draws about nursing and class as in lower, upper and middle, signifies he wants to be in the middle class. Asked to clarify which kind of nurse in the feedback, he redid the drawing, and included that he was going to be a Registered Nurse because the Licensed Nurse Practitioner does not get paid as much.

**Cartooning Assignment 2—Picture Dictionary.** For the Picture Dictionary (PD) assignment I first went over each of the drawings and recorded what students wrote and drew. I then went over each drawing a second looking for themes to emerge. One theme that emerged during the assignment was, out of the six PDs, two had language levels at the preoperational level, one is an English Language Learner, and the other is on an Individual Education Program with a Special Education Teacher Assigned to his progress throughout his educational career. Another trend that emerged in this assignment revealed that the ELL student, and the IEP student respondents scoring at the preoperational level, missed the connection in the debt cycle to interest accrued on money lent by an institution. While they understood the process of how to enter into a financial agreement with an institution they failed to draw or label interest rates. The four neuro-typical people completed the drawings with concrete understanding, and drew, and labeled, these connections as well.

This cartooning assignment lacked the depth to engage the students, as these were formal concepts again without making a preoperational connection. Students failed to
create inner meaning, especially JRC the ELL, and DM the IEP student, as their scores indicate they are still existing in a preoperational language state that will not allow them to access the world through their brains, and this can at least continue to make things hard for these students to understand their surroundings. Also, there is a lack of originality in the drawings. Even though I elicited responses from the classroom, many students were involved, the others were not and when they came back from that transition, many were lost as to how to complete the drawings, as the concepts were formal, and given in a formal manner through the video. The students needed the information to connect directly to them, in order for those students to begin to acquire meaning through an accurate understanding of how to use their language abstractly, in order to describe scenarios and actions in the future, and as a result of their actions, abstract thought.

A more effective manner of cartooning would have been to use the preoperational drawing from DYE assignment to have each learner then discover, through his or her own drawing, what concepts they needed to define. The preoperational nature of the drawings would have revealed the missing links between who, what, when, where, how, and why, of each of the concepts which the students are studying, related to completing the formal task of the CBA writing.

In particular I noted; KG had “great visual depictions of these concepts and how they relate to one and other.” In the analysis section I noted:

Concrete understanding of the definitions present. Within this picture there are several vignettes that capture the essence of each of the definitions, and some of the connections to each of the definitions. KG shows how to break up the
constituent parts, and reconnect them as a whole; this is something exceptional to this group. The beginning steps of metacognition are displayed by KG as she displays declarative knowledge, or what the student wants to achieve for her future, in her drawing, procedural knowledge. She accurately draws the steps needed to achieve what she wants, and conditional knowledge, or how she will achieve her goals via the resources that are available to her in her community, and that she may use to achieve the goals she has set. She presents them accurately in her depiction.

Another concrete example from JV indicated that the participant “Defines all the concepts and draws them out and shows an understanding of them. Does not show any accrual of interest in the borrowing and lending cycle.” In the analysis section for the drawing I indicated:

Concrete conceptualization of borrowing and lending. Taxes, he got the percentage in local area shows a formal understanding in those definitions. Income is a concrete picture of a check, symbolization but no interaction. Budget show interaction and a balance sheet, formal understanding in that budgets need to include multiple items planned out to pay.

We see flashes of abstract/formal thought as JV indicated variance in his drawing and showed it applying to budgeting and accrual, all formal/abstract budgeting concepts. The concrete thinkers that are moving towards formal/abstract show that movement in their drawings, as do the two preoperational students; they have glimpses of the formal, but only can get by, their using borrowed and hollow phrases as we will see in the CBA writing analysis.
I note here one conversation with JV regarding his PD assignment:

Our conversation revolved around, credit, borrowing, and lending explanation. Student makes the connection with debt, credit, cash, assets, and liability in drawing. Assets are houses and property. Debt for instance is a liability. We went over the student’s claims and evidence for his restaurant industry standards. Citing sources in student’s paper, he indicated his final draft needs an intro and a wrap up. I suggested adding something personal that led him into the business.”

When I interviewed JV later in the study, he indicated this:

Choice now is journalism. What kind of journalist do you want to be, I asked, blog or newsroom under editor? Answered, real journalist. Student then described detailed process of going to local college to get prerequisites out of the way before UCSC.

JV shows a concrete understanding of how to obtain a formal degree, that is abstract and that will help in his future. This is formal understanding, but JV has a glimpse, and can see himself there and he just might make it.

An example the drawing of JRC, an IEP student, was indicated as preoperational in this assignment group, as I noted:

Drew many of the pictures with words to explain. The symbols do the job and take the place of words and describes student in each sequence interacting with another person, this shows the student has a preoperational to concrete understanding of these concepts. Not sure she understands from her pictures credit. The other drawings are cohesive.”
In the analysis for this student, I indicated, “Only preoperational and concrete operational definitions apparent in drawings. No others, just one person and the interaction is with institutions not people, incomplete understanding of the definitions.”

The lack of true preoperational cartooning failed to allow the cartooning method to truly reach each of the students at their preoperational level. New learning connections are made, so they can create the concrete and then formal/abstract connections they need in order to score well on the CBA rubric, as we will confirm with the scores. The formal/abstract information given via video, and then connected via student conversation, and my I stories, were not enough to overcompensate for their lack of visual connections to the preoperational. These were essentially formal operational modifications that failed to reach learners at a preoperational level, as we will see in the scoring of the You and the Economy CBA.

Assignment 3—Cartooning Prompt Based on CBA Question. In evaluating the assignment Drawing Prompt Based on CBA Question (DBCQ), I first went over each of the drawings and recorded what students wrote and drew. I then went over each drawing a second time, looking for themes to emerge.

The preoperational IEP student JRC’s example is as follows,

Has some writing with arrows showing movement from graduating, to moving to Utah, going to college to attain associates degree in health sciences, then onto become a physical therapist. Not much detail in the drawings. Ties love of physical education to early education jumping rope, love of cooking and injury prowess attest to his interest in this subject.
In the analysis of this drawing, I wrote:
Real linear time frame with writing. Shows a concrete understanding of how this will carry out. Concrete understanding underlies all of this drawing. Formal concepts of order that will need to take in order to make his vision happen.
Details are relatively sketchy. Same as paper. While he understands the field very well, and understands that he has been in pain and has benefitted from PT, he also understands the large process, but I am not convinced from his paper, that he completely understands that his declarative knowledge, and procedural knowledge of how to accomplish these tasks are not evident in the drawing or the paper.
An exemplar for those that indicated concrete thought was described by JC as such:
Student drew in a circular pattern his path from HS to degree, has pictures of himself as the graduate, and then a picture of the degree, then being employed wheeling a patient, then getting health insurance through work, he has then drawn himself going back to school and getting scholarships to attend, followed by meeting new people, finishing the degree, progressing in his nursing profession to getting a new job with better pay and then retirement. There is no mention of family or anything else.
In the analysis of this cartoon I wrote:
Student shows understanding of the concrete concepts listed that flow into a plan, and shows direction which is the movement from concrete to abstract or formal thinking. Placing concrete concepts together to form new information and
connections, which are evident in the drawing, are needed to make formal/abstract conceptual connections. Some metacognition is present in his mapping, predicting and planning for his future, but fails to make repeated connections to take him to the abstract/formal level. While these are all logical steps that JC has lined out to attain his goal, and he described that in detail in his CBA, as signified by his score of 3/4 in the claims and evidence section, as averaged by the CWP PLC, he fails to make the connections needed to formally tie himself to his actual goals, with realistic concrete steps that would indicate higher order abstract thought. He understands the resources he needs to acquire, such as a degree, and, as he sees himself progressing through his career, an interest in self-improvement, as well as what his educational needs in the future will entail.

JC’s drawing includes a stick figure with a face and a hat marked “HS Diploma,” an arrow pointing up, and to the right of the paper, towards a square with squiggly lines with the label “Degree/Certificate,” an arrow up to the top of the page, leading to a stick figure pushing a wheel chair, with a stick figure sitting in the wheel chair; this signifies his helping the sick in his job as a nurse. The next arrow drawn on the 11 X 17 paper guides to a drawing to the left of the page center, showing a stick figure next to a large cross labeled “Insurance through work,” meaning, JC sees the benefit of his nursing job that allows him to have health care coverage, thus enhancing his ability to manage his life. JC drew another arrow towards the left edge of the page. This is a drawing of a large cylinder with a bow that signifies the diploma one receives from graduating with an additional degree. The label reads, “Scholarships to go back
to school.” The next arrow points to a drawing of two stick figures, side by side; both have faces. Their arms are over their heads, and their stick arms are connected with the label, “Meeting new people and helping people in need.” The next arrow points to a drawing labeled “Finishing school” with a drawing of a stick figure with a face, wearing a hat. “New Job” is the next label, with a drawing of a building with windows, then another arrow that leads the reader up to the top right of the page, where the next drawing is of two faceless stick figures, one with arms raised triumphantly labeled “promotion,” another arrow, bearing the label “Better Pay $$$.” Another arrow leads to the top right center that is labeled, “retirement.”

JC’s formal examples included in the Draw Yourself into the Economy are as follows, “Draws about nursing and class as in lower, upper and middle, signifies he wants to be in the middle class. Asked to clarify which kind of nurse in the feedback, he redid the drawing, and included that he was going to be a Registered Nurse because the Licensed Nurse Practitioner does not get paid as much.” In the analysis, I wrote “Formal understanding of where he wants to fit into the economy. Metacognition of where he sees himself in the economy is present in the drawing, listing examples of advancing in his career to be where he wants to be in the economy, making the appropriate wage for the lifestyle that he wants for himself. The choice of RN fits with that analysis. Lacking some formal understanding in the list of companies JV cited on his drawing of what company he could work for, they are not just places; they are industries within, and show a sub grouping that would only come with some flashes of formal understanding. As with many people, moving from concrete understanding of
the world to formal will lapse from one to another at any given time, depending on temperament and situation.

RE’s drawing of ideas starts on the left hand side of the page, and is labeled “College,” and “getting education.” There is a vignette style picture that has a stick figure in front of one of four windows, and a door that is drawn to look as if there is a building, a line to a drawing of a building labeled “Brickhouse,” with two titles: one at the top of this building says “Creates Jobs,” and written below, the phrase “owning business creates jobs.” A stick figure stands in the middle of the door with the label “me.” There are six stick figures lined up outside the drawn building with the label “workers.” A diagonal line is drawn sloping from the “Brickhouse” down to a drawing of a stick figure, with a rectangle that has a dollar bill sign on it. The figure stands in front of a drawn plate of food on top of a table, with a line to a rectangle symbolizing a check, with the label, “paycheck because of customers.” A short drawn line connects to an oval. Written on the outside are the words, “employees,” “my business,” and “other workers,” which appear around money symbols, drawn on the inside of the oval. A line connects to three stick figures under the label “workers.” Next to this line is drawn eleven stick figures in a line, labeled “customers.” Below that a label reads, “too many customers.” Two drawn rectangles feature the labels “resume.” The label next to them reads, “hire to meet the demand.”

In terms of cognitive development, RE’s drawing exhibits concrete to formal understanding. Some specific concrete examples include the steps he will have to take to get to his goal; these steps are mentioned and drawn, but no detail about how each
step along the way will be attained, just that it will. The assumption that he makes, which speaks to concrete thinking, is that this restaurant will be a growth industry, and he can serve more people, then hire more people. There is no mention of what kind of people he will hire, or how he will motivate them to work. All of these ideas would be alluded to, at least, if not approached at length in his drawing or paper, none of which occurs. Since pictures are drawn rather than just words appearing, RE shows a noticeable difference in the developmental landscape of his work in latter stages, compared with some of the work he turned in at the beginning of the study. This also aligns with his paper, wherein there were lapses between the formal understanding of how his behavior can affect others, and that working with others might be something RE will need to work on. But glimpses of how his business affects the community, and vice versa, start to be explored by the student towards the end of the project that had not been thought of at the beginning.

KG’s drawing starts at the top left hand section of the paper. An oval shape, shaded inside with a dark circle, features lines connecting it to a stick figure wearing t-shirt and shorts, and a basketball. Lines guide us in a circular path, snaking from the top left corner to the bottom right corner; along these lines are various stages, the first of which is marked “CBA.” A stick figure with a backpack is standing under the label. Some dashes to the right are drawn, and then the label, “Last Days of School,” shows a picture of a stick figure lying in front of a TV, with a piece of paper to represent school work, which represents watching television at the same time. Lines move to the left that lead to two stick figures; one says in a speech bubble, “Hands Up!” to the other. There are more dashes to the right, leading to a stick figure with hands raised.
The label reads, “Semester Break.” More dashes to the right lead to another stick figure shooting a basketball. More dashes take us to a drawing of a certificate that reads, “Honor Roll.” Yet more dashes snake around the right edge of the paper, and curl back to the left side, and appear with a line of stick figures. On the left is a larger stick figure, then three more, each diminishing in size; the first is labeled “Step-Dad,” the second, “mom,” the third, “sis” and the fourth, “brother.” Dashes connect to a rectangle in the middle, which reads, “Diploma.” A mortarboard cap is drawn above; more dashes connect to a sign that reads “Central Washington University Wildcats!” Dashes connect to a rectangle that is colored in with marker, and in the middle is a question mark, labeled “My own business.” Three more dashes, then the symbol for money is drawn, with two unrecognizable, filled in, squiggly shapes.

JV’s drawing is very intricate and detailed; a person sits on a small box with knees raised to chest, and right hand placed over the knees. The left hand is on the ground, fingers grasping the representation of a $50 dollar bill. Next to him is a detailed drawing of a garbage can. On the left side is a flow chart that starts with the label, “my mom.” A line extends to the label “me,” a line to “friends,” another line to “work”, another “government,” “citizens” and onto “working!” The label, “my mom,” is also directly linked, by a line, to the government. JV draws the connections by which he is tied to the economy, which demonstrates a concrete understanding of the economic relationships he is engaged in, from the list on the first drawing. Depicting himself sitting next to the garbage most likely indicates that, as a 18 year-old, he might not be too sure of his future, a fear many in his social group members go through, when they are about to graduate from high school.
DM’s drawing is a preoperational list of labels with arrowed lines, starting in the upper right hand side of the paper, and moving to the left. The first label is “moved to Vancouver tell I was 18 (sic),” next, across the top is “Graduated,” featuring a picture of a motorboat next to that label. “Moving to Utah,” is the next label, followed back on the right side of the paper by the label, “go to become a physical therapist,” followed by the label, “go to college,” next, a line with an arrow to “get associates in Health Science.” While concrete levels of planning and detail are evident, these are just letters, and a timeline, for this student in his drawing. There is no compare and contrast of one program over another, or what track DM will take in his drawing or CBA. The work DM did leading up to writing the paper, including the paper itself, left many questions as to how DM would be able to carry out the steps in order to become a Physical Therapist. He does not seem to have a very detailed plan, and demonstrates in his paper, and his drawing, very broad strokes with numerous generalizations.

JR’s drawing is labeled at the middle top, “Current Economy.” On the top left is drawn a map of the continental US. On the NW, is a squiggly line represents a river; a highway is drawn across the north, on the side of which are trees. A mining operation is drawn where the Rocky Mountains would be. A large city in the Southwest represents Los Angeles, and a car where the state of Texas would be located on his map. Near where the plains begin, JR has drawn a picture of farming, and on the east coast, a buoy is drawn. In the middle of the page is one figure, bent over, supporting the spelled out letters of T-A-X with another person grasping the other side of the writing, as if to assist in the carrying of the word “Tax.” Below that are two hands exchanging representations of $100 dollar bills. The last drawing is of a
scale, with a gas can on one balance, and on the other balance are moneybags, as indicated by the money symbol drawn on each. On the right-hand side is a written list of life goals: “education,” “college,” “open my own business,” “automotive tech.”

While these are interesting drawings of the current state of the economy, they only connect personally to the artist in an abstract way, so I wonder how much of the economy he associated with personally. I know that automotive tech is a reality for this student, and that he is interested in this, but the assignment lacks the personal connections. This makes sense, as JR is English Language Learner; English is his second language.

**Date source Five—Student interviews**

From the student interviews I conducted, which were corroborated by data source 2, video recording, I captured five of the conversations I had with student participants and encapsulated them. I did not analyze the language of the respondents; I just captured the conversations in general, and the questions that students were generating. Of the five students I interviewed, their average was 3.33 for the average CBA score, and 3.24 for the claims and evidence score, a significant difference between the average scores, and the average score on the *You and the Economy* CBA. One respondent from 3rd period was not corroborated, as that class was not videotaped. Ultimately, the student interviews have been incorporated in the student assignments section.
Date source Six—Cultural Interactions CBA and Economy and You, CBA

Writing.

Table 1

*Overall Scores, and Claims and Evidence Scores for the Cultural Interactions, and You and the Economy Essays*

<table>
<thead>
<tr>
<th></th>
<th>Cultural Interactions</th>
<th>You and the Economy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Overall</td>
<td>Claims and Evidence</td>
</tr>
<tr>
<td>JC</td>
<td>2.3</td>
<td>2.3</td>
</tr>
<tr>
<td>RE</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>KG</td>
<td>2.4</td>
<td>2.4</td>
</tr>
<tr>
<td>JV</td>
<td>1.7</td>
<td>1.7</td>
</tr>
<tr>
<td>DM</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>JRC</td>
<td>1.7</td>
<td>1.7</td>
</tr>
</tbody>
</table>

The left side of the table describes the six students and their Overall scores on the first CBA, *Cultural Interactions*, along with a score on Claims and Evidence. The right side compares the scores from the second essay, *You and the Economy* Overall, with Claims and Evidence scores. JC scored a 2.3 for the *Cultural Interactions* CBA, a 3.16 both for *You and the Economy* CBA average, and claims and evidence rubric scores. RE’s *Cultural Interactions* essay was scored 2; his *You and the Economy* 3.31, and his Claims and Evidence score was 3.16. KG scored a 2.4 on her *Cultural Interactions*, a 3.25 on her *You and the Economy*, and her Claims and Evidence score was 3.3. JV scored a 1.7 on the *Cultural Interactions* Essay, a 3.33 on *You and the Economy*, and a score of 3.16 on the Claims and Evidence. DM, an IEP student,
scored a 1.47 on the *Cultural Interactions* CBA, a 2.5 on the *You and Economy* CBA, and the same 2.5 on the Claims and Evidence breakout. JRC, an ELL student, scored a 1.7 on the *Cultural Interactions* CBA, a 3.76 for *You and the Economy* CBA average, and 3.5 claims and evidence rubric scores.

**Summary of Findings for Question 2**

1. As brain-based learning strategies are being implemented in real time, what is the nature of the process of using brain-based interventions? In documenting the brain-based interventions, what decision-making factors are considered when designing the unit of instruction?

In answering question 2, while the students in this study have completed all the steps, much of the language as we will see in the CBAs leaves the scorers with the impression that many of their claims failed to be validated by adequate evidence that made sense given the language they presented in their papers. Especially DM the IEP student, and JRC the ELL student, show, through their hollow phrasing, and borrowed phrases, the inability to make connections to the material I presented. We will observe this in the student writing sections further in this chapter

**Samples**

**Descriptive Statistics.** The average score for the *Cultural Interactions* Essay, that the six respondents turned in prior to the beginning of the study, was 1.92 on a four-point scale. There were no differences between the claims and evidence scores and the average for the *Cultural Interactions* Essay. *You and the Economy* essay was scored by the PLC averaged 3.01/4. I isolated the claims and evidence score by focusing on
Essential Academic Learning Requirements (EALRs) 2.1.1, 5.2.1, 2.2.1 and 2.4.1, which represent the claims and evidence scores of which the mean was 3.20. The difference between the claims and evidence mean score, and *You and the Economy* mean score was .19. The average difference between the Cultural Interactions Essay, and the *You and the Economy* Essay, was 1.28. While the average of the claims and evidence section was 3.20, that does not represent a statistically significant movement on the part of student respondents, between the claims and evidence scores in *You and the Economy* essay, and the average essay score. Instead, the statistically significant movement occurs between the *Cultural Interactions* essay class average 1.92, and the *You and the Economy* essay class average, 3.20. The most significant contributors to this change are the times that occurred between the two writing samples, and the interventions placed during that time frame, including the time frame of this study.

Students need time to get better at writing after the first attempt, and to go through the CBA process. Another difference was that during the *Cultural Interactions* CBA essay preparation, there was no detailed prewriting drawing and writing present in the preparation for the *You and the Economy* CBA.

In analyzing the CBAs, as stated in chapter 3, each teacher in the CWP PLC, read and scored the CBA, according to Appendix F CBA Rubrics, to come up with the numeric scores that were averaged, and the same with the *Cultural Interactions* CBA. My scoring was inconsistent with my colleagues for Cultural Interactions CBA, so we recalibrated, and my scores were more consistently matched with one other teacher in my PLC, whom I have taught with for a much longer time than our other grader. Most likely, this is a bias that is indicated by the fact that the seasoned teacher and I have
calibrated before. We share some of the same students, and are biased towards their success on this CBA. I know I was certainly biased that my students/participants showed growth. We are systemized towards that through employee evaluations based on State guidelines.

What I found in the difference between the scorers, (the three teachers in our PLC,) was that the results by the scorers with the most teaching experience resembled the scores more so than the one person that had not taught the subject before. I also noted that the Cultural Interactions CBA was a bit more rigorous than the You and the Economy, in that it asks respondents to displace themselves a bit further than just themselves and the economy. Displacement is a formal/abstract trait and exists in You and the Economy, and requires transposing oneself into the future by connecting to one’s past. Cultural Interactions asks the students to displace yet step further, into another community, which calls for an additional level of empathetic concern, and which, is a formal task in itself. That is what I have been instructed is best, and, as state law, requires me to show, every year, multiple times, as required by state law.

Once I scored these essays, I read them all again for this study in order to note what arguments were made, and which also included the scores. I read them through again with the same definitions from chapter 1, and analyzed the writing through those definitional lenses. Of the six respondents, four matched the criteria of concrete, and two match the preoperational.

**Student Participants and Their Scores with Analysis of CBA**

DM was a student that scored a 1.47 on the Cultural Interactions CBA, a 2.5 on the You and Economy CBA, and the same 2.5 on the Claims and Evidence breakout.
The difference for this student, between the two essays, was plus 1.03. I noted in his paper:

Student started with his love for Physical Therapy (PT), having benefitted from it for the many injuries he has sustained over the two years I have known him. He is a student athlete and is often injured. He was using the argument in his paper that PT a good job even if the education is expensive, to order to attain the degree. Argues that PT can help local economy and national save money with reduced health care costs for healthier population. Makes argument that Dr. of PT will allow comforts in any downturn of the economy in the future. For the analysis of this paper, I noted “Shows a preoperational understanding of the defining factors in the economy, and an understanding of the technical aspects of nursing.”

Student writes:

This field is one of the most interesting and successful, in my opinion, because of the high amount of jobs that needed to be filled, and I will be able to help hurt people, and make them better. Physical therapy is such a demanding job because it is one of the few jobs in the world that cannot be relapsed over by robots or overseas.

This is the second time I have had this student in class. He was in my sophomore World Civilizations class two years ago. From his gaze, gait, giggling, and monotone voice, I can infer that he has some structural, and functional, issues with his uptake of information. He is not a learner that can easily pay attention; he must access his motor cortex through talking. He has a tendency to lose track, focus of thought drifts often, and needs to be redirected often. That has changed in frequency, as it occurs less
frequently two years later. He often talks to neighbors and me before, during, and after class, as if there were no other people in the room. This occurs in a classroom full of 17-18 year-old students. He over shares with people about his physical conditions.

I know way too much about every injury he has sustained through the multiple sports in which he chooses to participate, during after school sports programs offered at this high school. All of these observations over time also tell me that he is not neurotypical, as he not only uses language wrongly, he also does not astutely assess social situations, and his appropriate place in them.

The language structure is not fully functional, and function of meaning is missing in the writing. In his first sentence, he is a preoperational thinker and language user, specifically in the phrase, high amount of jobs. This is not a correct usage, or even a turn of phrase, so this subject matter has not been internalized, and, as he is existing at the preoperational level, he does not understand how it affects his ability to become a Physical Therapist. As the concrete level, he would need to clearly state those connections, with accurate structure and function in his writing. Some of his language is concrete, but that does not create a formal or abstract notion that he might not be able to actually attain the goal he has set. In the second sentence, he misuses the word relapsed—he means replaced—while he saw this on the video, and has the preoperational level of understanding that he could actually be a PT, because he has been a patient of PT his whole life. The many physical ailments he has endured have inhibited his ability to learn and grasp information, beyond the preoperational level, to the concrete.
JRC, an ELL student, scored a 1.7 on the Cultural Interactions CBA, a 3.76 for You and the Economy CBA average, and 3.5 on his Claims and Evidence rubric scores. While the rubric is set up to measure the process of how students write, often it misses some of the language, which demonstrates that frequently, the phrases this student uses are borrowed and hollow. For example, a borrowed phrase in JRC’s essay reads:

Nationally the automotive industry is facing a difficult if not unprecedented period of competition and capital spending in its efforts to compete with Japanese automakers in order to meet pending government regulations on emissions control and safety. The domestic automotive industry is highly mature, the peaks and troughs in vehicle demand essentially parallel economic activity. Vehicle production in North America is an important part of their total sales, so this makes them highly want more automotive technicians in the auto market industry.”

All of those sentences are borrowed from a source. While I wonder if the use of the word *highly* was inserted to offset the amount that was borrowed by JRC, or JRC just did not understand the text he was transcribing, and implanted *highly* as a word he might use, without understanding that it does not apply to place the phrase as a descriptor. Or, JRC simply forgot a word in the transcription such as *highly trained*.

An example of a hollow phrase in JRC’s essay is as follows:

An automotive Technician is located in today’s cars industry as one of the moist important jobs that our country has in the job fields because if offers good paying, full time work benefits, making of this job position even more saturated than the
job market for auto dealers. For example, Modern technology has impacted a lot more than we can think of in this case since everything we drive nowadays has technology on them require ring more Automotive technician to help out fix issues on these evolution ate cars.”

In this case both sentences are JRC’s creation, but are mixing subject, action and verb. It is clear that writing in English is difficult for JRC, in order to coherently express his thoughts. This is another reason we know that the brain-based interventions did not work as administered. If they had, JRC might have been able to express himself more succinctly. He makes a great attempt at making his language expressive in his own words, and I am sure after spending more time immersed in speaking English in America, he can be successful in getting his automotive degree.

One of the student respondents, JC, scored a 2.3 for the Cultural Interactions CBA, a 3.16 both for You and the Economy CBA average, and claims and evidence rubric scores. The difference for this student, between the two essays, was .86, a minimal gain at best. This particular student’s writing indicates his own original writing throughout the paper. JRC is a frequent contributor to sharing during class discussions. His knowledge of the different drug classifications, including the reactions one would feel under dissociative anesthetics, and his interest in the cultivation and growing of medical marijuana business outside of school, indicates the base for his nursing knowledge.

This description indicates the preoperational to concrete nature of the relationships these classmates engage in with one another inside, and outside of class, and why they rely on Constructivists environments like schools so they can learn how
to socialize through a mediator, me, their teacher. Before this study, through my classroom observations and his interactions with me, and others, I uncovered an out-of-school incident between JRC, and two other students in this class, that is worth sharing. I gathered information from both sides. A Hispanic IEP student wanted a ride to the mall to get his girlfriend a present, and asked JRC, a car owner and budding entrepreneur, if he would drive him. In return, JRC asked him how much money the Hispanic IEP student had towards gas, and explained that he would take him to the mall for money, since they were not friends. The Hispanic IEP student replied $30. JRC took him to the mall and overcharged him for gas. The Hispanic IEP student got to the mall, spent most of his money, and then did not have enough to pay the amount JRC wanted for the ride, to and from the mall. JRC returned the student to his home and told him he owed him money. The Hispanic IEP student asked another Hispanic student, a wrestler, to speak for him, and tell JRC that he was not going to pay him, and that if JRC pursued payment he would have to deal with him.

After discussions moderated by JRC and the other two Hispanic students, and me, we came to a resolution that both sides might have been operating under different sets of understanding, that were not mutually beneficial to either. Both parties agreed that each of their actions were motivated by selfish desires, preoperational needs and wants that could not be settled without concrete bounds of laws, and needed a formal/abstract solution. In bringing these parties together, an important lesson was learned by both sides about operating in self-interest. Both sides agreed that the resolution would be for the debt to be forgiven, as it was most likely not equal recompense for the act of driving to the mall, and that the other student might have
overpromised the money, in return for getting a ride to the mall. While concrete issues are at stake here, the behavior on both sides is preoperational to concrete, and is why they need my help in sorting out the matter. This is consistent with the findings in the assignments, and in their writing.

Several spots are intriguing in terms of grading; the essay is fine but grammatically and functionally, it is lacking proper subject verb and object. For instance, he writes:

Hospitals are huge moneymakers but not all hospitals are for profit. There are many free clinics and nonprofit organizations that help people of local communities that can’t afford health insurance or an expensive emergency room bill. On the website http://www.aha.org/research/rc/stat-studies/fastfacts.shtml it shows that there’s about 5,627 registered hospitals in the United States and 2,870 are nonprofit (sic). That means over half of the registered number of United States hospitals are helping our American citizens that are in need of care and aren’t doing it out of corruption and greed (sic). These non-profit organizations keep people from gaining debt and possibly dying from a severe sickness. Being able to work in the medical field allows you to help these vulnerable people that have fallen upon tough times. You get to benefit these people giving them proper care, while you are benefiting yourself making money and a career with jobs that are very rewarding.

What JRC attempts to understand is formal, but his language function and ability to express himself still show signs of preoperational and concrete misunderstandings of the formal concept. While he can explain the big picture there, by placing himself
inside the field of nursing, how he will operate inside the system is a mystery to JRC. For example, “These non-profit organizations keep people from gaining debt and possibly dying from a severe sickness.” JRC might mean, for instance, since the nursing industry pays well, I will be able to concentrate on healing the sick. There is a more formal aspect in this approach, as JRC will have to understand how his role is intertwined, whereas his sentence structure and language do not carry that meaning to a formal/abstract concept, only concrete.

As we can see from JRC’s writing, JRC does a great job of analyzing his sources and providing arguments, however, the formal or abstract nature of his language usage still escapes him. For instance, when he writes “That means over half of the registered number of United States hospitals are helping our American citizens that are in need of care and aren’t doing it out of corruption and greed,” he is combining two separate and distinct ideas into one sentence (sic). This is a great example of concrete thinking, while showing a glimpse into the formal, mixing and matching the subject, verb, and noun, as well as the time placements and current grammar. Even though the CBA Rubric gives us tools to measure claims and evidence, it does not take account of, or score for grammar, which can pick up these thinking/language issues.

JC, as well as all the others in the study, shows glimpses of formal/abstract thought, but the language is not formal/abstract, even if the CBA rubric scores at 3 or 4. First, seventeen and eighteen year-old students will naturally fluctuate between formal/abstract and concrete, and even preoperational, sociocognitive levels. Second, the CBA rubric, while a formal/abstract tool, might not be able to be completed by students that are not interacting at the formal/abstract level. Thus these students cannot
complete the task without borrowing heavily, or with hollow phrases, as was the situation with two of the participants, the ELL and the IEP student respectively. In the case of the neuro-typical learners, as we are seeing, the abstract is not consistently attainable, just in fits and starts.

JV, a student that scored a 1.7 on the Cultural Interactions Essay, a 3.33 on You and the Economy, and a score of 3.16 on the Claims and Evidence breakout, was one of the best cartoonists. Like DM, I had JV as a sophomore in AP World History; he had a difficult time keeping up and being successful in that class, but at times, his writing showed promise. His final CBA is based on two arguments, and while it scores as passing, shows three hollow phrases that attempt to explain formal/abstract concepts, but miss the mark. For example, “Journalism is one of the weirdest professions in terms of the economy.” This is an intro sentence, and what he means to convey is the volatility, in the news market, between print and online journalism. While JV backs with appropriate evidence and the paper matches, the next hollow phrase, “Journalism is very popular with digital media as well as being a large figure on twitter.” JV is talking interchangeably about media platforms, and how Twitter maybe connected, but he does not seem to understand that there is a role, and that is concrete knowledge. JV’s Prewrite indicates the use of a SEE Statement, and indeed, the same SEE Statement on the prewriting reflected the same ideas presented in his final CBA. While JV connected on a concrete level, he shows flashes of formal/abstract, as we saw also in his drawings. At the start of this assignment, he went from Treasure Hunter to Journalist, and by the end, to a concrete argument as to why he should pursue this path.
RE’s *Cultural Interactions* essay was scored 2, his *You and the Economy* 3.31, and his Claims and Evidence score was 3.16. Throughout the assignment, I followed RE with multiple conversations. In fact his paragraph is a synopsis of one of the conversations we had prior to his completion of the final cartooning prompt. Here is the transcript:

> If I continue to pursue my dream of being a small business owner it could have a large impact on the local economy. In a strong economy, small businesses will gain customers and in turn will have to keep up with growing demand while people pump their money back into the economy. To keep up, small business will hire more workers employing the unemployed, which can be good.

While these ideas and language are certainly RE’s, they are concretely structured; for example, the word gain does not connote the correct concept he is attempting to explain. Gaining weight can happen, but customers or clients can rise or increase for example. If RE had a preoperational basis he would be able to make that connection and clear up how he would integrate himself, increasing his business presence.

As he continues to engage in this family business, RE will acquire these concepts, and as he works in the business, he will learn more about what he writes. Such as, “I spent my whole life around people who built there own business because my parents own a restaurant and my grandparents owned a restaurant back when I was a little kid.” Beyond missing the their and there connection, RE also shows some preoperational thought in constructing his career choice, "I am going into my family industry because I can and also I can make money in a good economy" is a preoperational idea. While his paper makes concrete arguments that helping create
business opportunities puts people to work, he just calls that good, and does not define how that affects others. While RE speaks of recession and how to structure his business to minimize his risk, he is still at the beginning stages of understanding how that could affect those other than himself, who might not own a family business. All of his writing points to a concrete understanding, with some formal/abstract glimpses of how recession and prosperity in the restaurant business could affect his family establishment. Ultimately, we hope that RE is allowed the experiences of, as he says in his conclusion, “Being my own boss will allow me to run and manage how I feel is necessary.” The larger questions of how to attract and retain an adequate workforce, or any other managerial plans, are not included in this paper, and if one was at the formal level, one might include them in this paper.

KG scored a 2.4 on her *Cultural Interactions*, a 3.25 on her *You and the Economy*, and her Claims and Evidence score was 3.3. She backs her claim that becoming a self-employed lawyer will allow her to help the community, as she states, “Opening the firm can also help other small businesses with legal representation against major industries. Without law firms, rich people become richer and prey on the poor.” If she understood this on a formal/abstract level, she would be able to explain how her presence and law specialty could assist specific clients in resolving their conflicts. However, the lack of her preoperational understanding also comes through in the paper, as she is not able to describe the steps she will need to become a lawyer, and to own her own business, and what type of business that is. She is on her way to state university, as is one of the brighter students in school. I had KG as a sophomore in my general world civilization course, and her writing and thinking has improved, but she
still is not making the connections at a formal level. While her drawings and writing shows glimpses into formal/abstract as much as any of the other students, the ability to sustain this thought in writing, for the task of the CBA, was difficult for her, as well as the respondents.

Summary

As the curriculum unfolded, my I story went from preoperational, to concrete, to formal. My Questioning methods went from knowledge and level one, to synthesis and evaluation of top level. In scaffolding the student respondents, I used many methods: think/write/pair/share, discussion, cartooning, video based information, articles, and formal writing, to assess their sociocognitive levels based on a state CBA rubric. The decision-making factors were documented, in detail, previously in this chapter through the teacher journal, video recording and administrative interviews. Getting high school students to think formally/abstractly, consistently, is difficult with the neuroanatomical structures of our 17-18-year-old respondents. Additionally, my misapplication of the preoperational interventions section of the study both played a role in how the six respondents completed each of their CBAs.

Ultimately, two students, JRC and DM, completed the You and the Economy CBAs at the preoperational level, with hollow and borrowed phrases and some glimpses of concrete thinking as established in answering. Four students showed concrete level thinking, with brief glimpses of the formal/abstract, even though their scores are passing, at an average of 3. This shows the average score of the You and the Economy CBA was 3 for the six respondents. These findings are inside the acceptable range of scores from where they started, prior to the study. With the comparative
"Cultural Interactions Essay," all six respondents averaged at 1.92 on a four-point scale. While progress was made for these six respondents, one area that was compromised was the cartooning, when I failed to make a correct intervention at the preoperational stage of presenting the material. If this intervention had been made, I wonder if this would have impacted the student’s thinking and raised it enough to raise their scores to 4/4 instead of 3/4, which was the average of the six.
Chapter 5: Implications and Conclusions

The purpose of this study was to investigate whether the use of brain-based pre-writing strategies will improve students’ abilities to support claims, with evidence, on a state mandated classroom-based assessment. Specifically, the research evaluated the working hypothesis that using brain-based, pre-writing activity in the non-fiction, expository writing process will assist students in their performances, as assessed by the Office of the Superintendent of Public Instruction for the state-approved You and the Economy CBA Rubric. By using brain-based strategies as a pre-writing activity in the non-fiction, explanatory, secondary social studies writing process, I hypothesized that those students would demonstrate logical use of claims and evidence in their typed essays.

This research study was guided by two overarching research questions:

1. As brain-based learning strategies are being implemented in real time, what is the nature of the process of using brain-based interventions? In documenting the brain-based interventions, what decision-making factors are considered when designing the unit of instruction?

2. What changes—if any—are demonstrated in student writing performances on a Classroom Based Assessment, when brain-based learning strategies are implemented over the span of a research cycle?

These research questions were answered through a research design involving a cycle of instruction, which culminated in an explanatory writing sample. By using cognitive psychology theories to refine learners' concepts to promote learning, I hoped to improve students’ abilities to make claims, and provide proper evidence for those
claims, as measured by the Office of the Superintendent of Public Instruction for the State approved *You and the Economy Class Based Assessment* (CBA) Rubric. The process of my decision making, as well as student assignments and writing samples, were examined to evaluate the effect of brain-based, pre-writing strategies, used by students to complete the CBA.

**Interpretations**

JC’s understanding of the steps he needs to carry out his goal of becoming a nurse is evident in his drawing, as well as the writing. In his writing, JC explicitly addresses the economy and the role played by the medical industry. This essay shows JC’s strong formal understanding coming through in his writing. This is evident in his drawing as well, with the pictures that are drawn instead of written words, which would only indicate a concrete connection. JC’s formal operational understanding comes through in this paper; he explores formal themes in his Claims and Evidence sections of the CBA. He uses proper evidence to cite his claim, and his evidence supports his claims.

JC’s examples of formal thinking include his argument regarding the health care industry’s place in the economy. He demonstrates his thinking in relation to ways in which he could create an opportunity for himself by entering this field, as well as the fact that this field represents a growth industry. JC provides evidence to support his claims, and does so for each of his claims, from his formal sources. The language of his argument is formal, and matches the evidence from those formal sources. Evidence from different sources appears, and JC provides quotes and information that help make his points. JC’s information in this paper, and on the drawing, match,
meaning, the drawing supported his work on his CBA. There are glimpses of formal understanding in explaining how hospitals can impact community, and there are plenty of examples to show why he scored a 3.16 in both sections.

RE's drawings, as they are drawn, rather than just labeled, indicate at least a concrete to formal understanding of the steps it will take for him to become a restaurateur. RE’s opening paragraph takes us from preoperational, what he wants to do with his life, to concrete. His parents already own a restaurant, he has lived that life, and he will be going into the family business. These indicators present as formal thoughts, including how his business contributes to the economy at large, which is the beginning of formal thought. As RE moves through his life, these formal connections will become more real, as he learns from experiencing the events. RE’s CBA has many claims tied to formal thinking, regarding how the restaurant business can provide income for families in the form of jobs, and he backs those claims with evidence that is factual in nature. Another sign that formal thought exists in this CBA and connections also appeared in the drawing, and in the paper as well. The concrete nature of understanding that RE exhibits is on display, though he fails to establish the particulars of the type of employees, or atmosphere, or even menu selections that might suggest a consistency of formal thought. Like all other adolescents, RE does not operate full time in formal thought, but the time spent in that mental framework is increasing, and will continue with age and experience.

While KG’s drawing focuses on the steps that need to be completed in order to start and run her own business, in her paper, the business she runs is a law firm. For
KG, the change came in her rough draft, where she decided that the business she really wanted to start was in law. Her claims and evidence in *You and the Economy* CBA were supported by valid evidence, and the use of formal examples from periodicals, in order to make her point. Though there is room for expansion in the paper, and for more detail in what field of law she might practice, her thinking is still emerging, and is in the concrete stages. Her formal thought comes out in the ideas displayed in her arguments, and shows a good grasp of the reality of opening a law firm. I am not so sure she formally understands the ramifications of being self-employed. Her lack of depth in exploring the evidence shows that she has a concrete understanding about how she will fit into the legal profession. Again, like her peers, KG has glimpses of formal thought, and the ability to make claims and support them with evidence, but life experience will hopefully fill in, and KG will progress as she gains more life experience. KG acknowledges that she may have a hard time with running her own law practice, which shows she understands that she must grow to meet this future demand; this a sign of formal thought.

JV’s drawings are specific to him, and are preoperational to concrete connections. Once he is committed to the act of becoming a journalist, his claim that journalism is a hard profession to make profitable in this day and age, and that, while digital media is a fast growing avenue, compensation for this service is too random—all these thoughts are represented in oddly worded language. However, the evidence that he draws upon to back up these claims makes sense, and is backed with good sources, and succinct arguments. While JV’s drawings helped him formulate his writing, like KG, his final decision on what to concentrate upon, came during the
writing of the rough draft. The drawing helped to establish the preoperational and concrete thinking that JV needed, to make sure his claims and evidence matched, and provided valid information to support his claims with germane evidence.

DM’s been often injured, and his experience of wanting to help others, comes from those in his past that have helped him to feel better. His drawings are just words, an indication he does not have pictures that go along with his words, and that his understanding could be deeper. DM’s claims are very formal, with borrowed language and facts that he may not really understand. When he relays his own experience, he has problems with writing in complete sentences, and expressing his ideas. DM’s writing and drawing show preoperational, and some concrete forms. There is very little formal evidence to support his claims. He often uses himself as the primary source of information, which does not align with the CBA. DM believes this is his calling, but he may not be able to reach his goals without a lot of help and hard work. He will need to realize that life experiences, and those objective life experiences with which he will be engaging, will come into more and more focus, as he moves into other social institutions.

JR’s drawings are representations of drawings he found on the internet. JR has a hard time visualizing written words in English, as he is a Spanish speaker, and is learning English at school only. In creating these drawings, he was able to grasp an understanding, but only a very concrete representation of the claims and evidence he provides in his paper. The most important evidence he provides for his claims comes from information from formal sources. JR uses borrowed phrases for his evidence; his
claims are in his own words, and he knows what he wants to do, which is to be a mechanic. But he shows in his writing, and in his drawing, an inability to communicate in a consistently formal manner, and that he has difficulty matching his formal use of tying claims to evidence, as well as describing personal experiences that connect him to this material. JR connects on a preoperational and concrete level in the English-speaking world, but gets along very well in the Spanish-speaking world. If he were able to formally recognize that deficit in his paper, it would show a formal English understanding. However, he is still struggling with writing, and the evidence is in his borrowed phrasing, as well as through the evidence that has meaning for him. That this is hard for him to convey in written English is also apparent in his awkward writing and phrasing.

Ultimately, the questions of, did using the visual interventions help students to write better claims and back them with proper evidence is yes, for RE, JV, KG, and JC. With the help of the visual interventions, a formal product, the CBA, was produced and scored at a level that would indicate proficiency. On the other hand, for DM and JRC, the drawing interventions were not helpful to making claims and providing evidence, as indicated in their CBA scores. DM’s drawings included not pictures, just words; his phrases are borrowed to produce the CBA writing. Therefore we can infer that DM did not make the formal connections to himself that were needed to fully represent his understanding of the complexity of the CBA. DM, with his cognitive issues, will not be able to fulfill his formal goals. His drawings show the lack of ability to draw himself into the scenarios, as he is constantly using words instead of drawings, a hallmark of concrete thinking. While JRC connects to the
material in a concrete operational understanding, he lacks the language ability to move into formal thinking, as his English is still developing. As he uses English more and more, he will make these connections. Moving both these students ahead will need more meaningful contact with each of their chosen professions, in order to see gains in understanding to the formal operational level.

Discussion

Week 1 Preoperational to Concrete. The scaffolding of student learning, through the daily use of CNN Student News, provided a stable anchor point for students to get important formal information, and to learn how that information is disseminated (Vygotsky, 1978; Foucault, 1965). My PLC uses CNN Student News, and each of us has classroom rituals around processing the information. My processing revolves around using it for examples much like the curriculum unfolds. This matches the video literacy for authors, as well as the multimodal processing for authors, as best practices for adolescent leaners in this technology age. When literacy is expanded by writing to moving images, still images, drawings, art, and photography, visual access can be explored through writing a physical action, and then reading a visual action, thus creating more access points for the brain to create greater understanding for the learner (Baars & Gage, 2010).

The six respondents’ cartooning responses to the DYE assignment, in the first week of instruction, indicated a preoperational-to-concrete understanding of the formal concepts they were drawing, since they could not explain the process it would take for them to get to these careers, when asked while they were drawing (Piaget, 1959). I noted students represented universal symbols of wealth, employment,
expenses, and opportunities of interest, as well as what they would like to engage in for their careers (Halliday, 1993). All cartoons had direct ties to themselves and their families' economic situations; this suggests a preoperational grasp of the material by a group of students (Piaget, 1959).

I found that the overwhelming majority of learners chose careers that also were tied to aptitudes they had recognized in themselves, and were using evidence from their lives to add to the claims of what they wanted to do with their lives, professionally, upon graduation. I hoped this preoperational task would allow learners to use the internet to connect to their own interests, in order to create student-based decision making, which is so important to moving concrete thinkers to formal/abstract thinking (Piaget, 1959). As we will see in data source six, many students, because of the close proximity of their graduations, had numerous ideas about local companies—small (local companies) and large (corporate companies)—that they were looking into for employment. I asked for this email so that those who were already moving to the preoperational ties would be able to make more connections to build upon later, connections such as finding articles for the List of Sources Cited, which will be part of putting together the CBA, towards the end of the unit. I closed with asking for the articles, for those that were interested in taking the next step (Piaget, 1959; Vygotsky, 1978).

In working with students who were dealing with the material on a preoperational basis (Piaget, 1959), according to Vygotsky, I needed to enlist thinking at a higher level, so as to raise their thinking and language to a concrete level to properly scaffold (1978). My scaffolding choices were the videos, my I Story time to the large group,
small group, and individual discussions with students (Piaget, 1959; Vygotsky, 1978). Discourse with students revealed misconceptions that I cleared up in those conversations (Vygotsky, 1978). As I scaffolded learners by going table to table, holding informal interviews, students were representing universal symbols of wealth, employment, expenses, and opportunities of interest as well as what they would like to engage in for their careers (Halliday, 1993; Vygotsky, 1978). In the Video Observations, the confirmation of the student interviews verifies that students had direct ties to themselves and their families' economic situations; the genesis of formal thought is evidenced in their drawings.

My I Story unfolds through the preoperational, to concrete, to formal, and gives visual context to the auditory stories that I highlight. I hoped they would personalize by doing the DYE. As the DYE is being completed, and the video The Economy is shown, students make those real-world connections. As seen in the student work section, these preoperational connections were not made, because my intervention was done at a formal level, rather than a preoperational level, as we will read about further in the implications section.

**Week 2 Concrete to Formal/Abstract.** As brain-based learning strategies are being implemented in real time, what is the nature of a brain-based intervention? In documenting the brain-based interventions, what decision-making factors are considered when designing instruction?

Creating visual, kinesthetic, and auditory streams of information so students could process information into abstract or formal thought, as carried out completing the assignments, especially the CBA, is a process that is brain-based. According to these
theories, in order for students to acquire language, and thus inform and raise their thinking levels, they must have multiple opportunities to manipulate, and work with information at the preoperational level, to build towards the concrete level, as measured by Piaget’s findings on western child development. Each level requires multiple manipulations before the learner can put multiple concepts together, in order to move on to the next level of understanding (Piaget, 1959). To get the best results according to Vygotsky, as their teacher, I must scaffold them as their knowledge unfolds and is refined. Vygotsky suggests it depends upon the individual learner to create meaning from the constructs each individual has built up over a unique and distinct space and time. This process allows students to create meaning through connections to their own lives. Getting together in their informal discussion, and rehashing the information allows them to reconnect from their personal experiences, over the time period since they last came together (Vygotsky, 1978). Processing time in groups, as well as through individual work, helps facilitate the connections for this new information (Vygotsky, 1978).

In the Picture Dictionary assignment, students drew the concepts as defined on a large 11x17 sheet of paper. This large paper was folded to make six panels, to help foster an activity that is visual, acoustic, and kinesthetic. It is a process that allows students to understand economic concepts, in order to help in choosing their careers, and in preparation for writing their CBAs. For the Picture Dictionary Assignment, the concepts that were introduced, and agreed upon, to cartoon for the Picture Dictionary assignment are Taxes, Income, Interest, Borrowing, Lending, Cash, Debt, Credit, Assets, Liability, and Budgeting. Unfortunately, I unintentionally engaged learners at
a formal level, rather than a preoperational level. In doing this, they failed to make the preoperational and concrete to formal/abstract connections they needed to revise their language to reflect formal/abstract abilities. This is another issue with not introducing the students directly to how the economy affects their pocketbooks.

The assignment allowed for discussion, and for lots of people to hear the information they have already acquired on each of the concepts listed above (Vygotsky, 1959). Adolescent brains find this inquiry method of presenting the information appealing. (Gallese & Lakoff, 2005; Lazo & Smith 2014). Scaffolding students by having them manipulate concepts from auditory processing centers in their brains, to visual processing centers in the brain, and then overlap that with a kinesthetic activity, allows for the movement of all students to a common task; participation is high in activities that activate those three systems of the brain simultaneously (Arwood, 2008; Merzenich, Nelson & Kaas, 1981).

These learning strategies developed with the brain-based activities suggests that cartooning allows them to access the concepts visually, acoustically, and kinesthetically, in order to refine the understanding of learners, to then create new and lasting information onto those concepts students already have, thus deepening learners' understanding. As students are discussing their information with multiple perspectives in the room, their knowledge is expanded (Vygotsky, 1978). Each time they share, and someone else shares and they listen, concepts are re-identified, coded, processed, and rehearsed, over and over so the student can acquire meaning through peer to peer interaction, small group interaction, and large-to-whole group interactions, so that all present can take part in the classroom learning tasks (Vygotsky, 1978).
In order to actively scaffold to reach most learners in the room, I found myself allowing for Wednesdays and Thursdays during the 3 weeks of the study, to flow into work days on DYE, and the PD assignments respectively, so that students had adequate time to finish this portion of the project, as well as discuss their progress with those around them (Vygotsky, 1978). Presented with formal operational video information, cartooning, and my availability to work the room, I made sure to converse, as well as pose guiding questions (Piaget, 1959). After breaks between days, students would have talking points to go back and discuss with partners, small groups, and then large groups, to make sure to give plenty of access points for all learners, and to reassess that information in order to strengthen the neural connectivity in all learners (Vygotsky, 1978).

In order to engage at a formal sociocognitive level approaching adulthood, students must engage multiple times in preoperational meaning-making as well as concrete or black and white-style thinking (Piaget, 1959; Vygotsky, 1978). The concrete sociocognitive level is where all our laws reside; right and wrong is housed collectively here, uniting our society, and reaffirmed daily in the everyday actions of people, whether conscious of the system they live in or not (Goffman, 1959; Piaget, 1959). Building schema according to Piaget (1959) must include taking others' perspective and when that happens, the glimpses for concrete thinkers into the formal or abstract way of thoughts occur. Students’ language is centered on how concrete concepts combine and form abstract thinking, where one can embody concepts and visualize the thinking in a more holistic manner. This is why I instituted this practice in the study.
Introducing the concept, and constantly refining these concepts for the learners, allows them to catch onto the assignment at any point of their ZPD (Vygotsky, 1978). The trend that appears is the refining of the story that I am unfolding, from preoperational, concrete, and formal/abstract (Piaget, 1959). Mondays and Tuesdays become days that are concentrated in collecting information and processing it through conversation, and as the weeks progress, I challenge the learner to take the next steps each time, by digging deeper into the information, by drawing in the Picture Dictionary the concepts that they think they need to know (Vygotsky, 1978). The ownership level is high, and this pays off by students completing their work, which is designed to allow them to understand, and gain concrete access to the material (Piaget, 1959). As the students define and refine the meaning of the words, and as student participants are talking about meaning while working with the material, further allows students to manipulate information, and in that process, draw out more understanding about the topic (Vygotsky, 1978). Consequently, some of the information they have seen, from the examples I have primed them with, is now coming to a deeper understanding for those that are completing the assignment (Piaget, 1959). Thinking is raised along with language levels as students are authentically engaged (Piaget, 1959; Vygotsky, 1978).

Just like the thinking and writing that takes place during the think, write, pair share, for building understanding, classroom wide, writing to the drawing allows students that last manipulation of information which allow those schema connections the brain needs to elevate language and then thinking (Piaget, 1959). Raising language levels raises thinking, and we want all students to write, speak, and modify, for the
others around them in order to have meaningful brain based learning experiences (Piaget, 1959; Vygotsky, 1978). Of course, we want formal thought to occur regularly in our adolescents, however, we know we are training, because the brain fully kicks into formal thought around 23 for women, and 25 for men (Bars & Gage, 2010).

As the students progress through cartooning images as representations of concepts that the students visually hold, they become aware of the root of their concepts, and can then build from that previous knowledge that we are extracting during the drawings (Berger, 2008; Halliday, 1993; Jung, 1964). Once the students connect at the preoperational level to the material, what they already know, and how it applies to them, can then translate into further knowledge and new understanding (Berger, 2008; Halliday, 1993; Piaget, 1959). There was plenty of time for students to share about their drawing in partners, small and large groups, to form language connections and refine their thinking for the next week (Vygotsky, 1978). As they refine their thinking by engaging with others in conversations about their projects, they are adding concrete meaning and refining that thought further, to form formal or abstract thought (Piaget, 1959). As students work on these assignments, it brings them to formal thinking, as the thinking ultimately required is abstract (Piaget, 1959). Students have to talk, and consider, and manipulate scenarios they have been presented with during class in their own heads, and share those thoughts with others in order to be able to formally engage with the world (Vygotsky, 1978).

My I story evolved, as the presentation evolved, into concrete conceptual presentation of information that must have a preoperational connection to the learner (Arwood, 2011; Bandura, 1962; Piaget, 1959; Vygotsky, 1978). Student stories, noted
in Journal 10, start to evolve as they make deep structural language connections to their families, communities, and the understanding therein (Piaget, 1959). The learners refine the drawings, and I have scaffolded their learning by including written instruction on the students' work that I hand back. The students then have multiple questions and feedback from me to guide them (Vygotsky, 1978). I want to make sure to put the assignment into context for all learners (Vygotsky, 1978). We completed this assignment so that the students in drawing and writing have now manipulated the concepts we needed to know, and their thinking has been changed from this experience. Once they put many of these concepts together, they start to build concrete knowledge into formal or abstract knowledge, as they are manipulating the knowledge they are combining. They develop concrete meanings to produce semantic relationships and strengthen their understanding of the material to a more formal or abstract manner, in which they can manipulate, and see change through the drawings and writing (Piaget, 1959; Hockett, 1960).

**Week 3 Formal/Abstract Operational.** As brain-based learning strategies are being implemented in real time, what is the nature of a brain-based intervention? In documenting the brain-based interventions, what decision-making factors are considered when designing instruction?

What changes—if any—are demonstrated in student writing performances on a Classroom Based Assessment, when brain-based learning strategies are implemented over the span of a research cycle?

In Assignment 3, a 20 minute free write on CBA Question Results by the 6 respondents, I found that all composed a general outline of what they were to write
and turned that in for the final paper. The analysis of this writing was created as I read and re-read this section, before I read the *You and the Economy* CBA essays, and then after, to confirm the connections for each of the writers, from their free write to the essays is discussed in more depth, later in this chapter. This intervention was designed to allow students to refine and practice their essays, and put them in writing before they drew them in pictures the next day, and before turning in the typed essay on the following Monday (Arwood, 2008; Bandura, 1962; Piaget, 1959; Vygotsky, 1978).

As I finish my I story, I tell the students that I will be doing drawings that reflect on my own journey toward choosing a career, and giving justification in the economy that I faced when I was their age, and had made the same journey to find my occupation. I shared those thoughts, in order to create a preoperational connection between the students and me (Arwood, 2008; Bandura, 1962; Piaget, 1959; Vygotsky, 1978). As I draw, I notice all eyes are on me, including my evaluator who documented this lesson as well. For the next twenty minutes, I started with drawing a picture of myself along the journey of my life, from birth, my parents and family, my schooling, interests that led me to find my calling of teaching. I also identify the milestones that changed my mind, and confirmed over the years what I wanted, as well as the economic situations I was faced with, which included the recession of 2008, as a backdrop to reinforce the boom and bust nature of the economy. I model for the students the process of how to draw these images, how to tie them together as concepts. I describe my thinking and evaluations. I model this so they can see this process evolve in real time, as a living example they can connect their mirror neurons to, and learn (Baars & Gage, 2010). Consequently, students draw themselves into their
own stories, and connect to the world to find a career they can see themselves in, as they complete the assignment (Arwood, 2008; Bandura, 1962; Piaget, 1959; Vygotsky, 1978).

As the curriculum unfolded, my I story went from preoperational, to concrete, to formal (Arwood, 2008; Bandura, 1962; Piaget, 1959; Vygotsky, 1978). My questioning methods went from knowledge and level one, to synthesis and evaluation of top level. In scaffolding the student respondents, I used many methods, think/write/pair/share, discussion, cartooning, video based information, articles, and formal writing, to assess their sociocognitive levels, based on a state CBA rubric (Bloom, 1956; Costa, 1991; Perkins, 2004). Vygotsky suggests when educators intervene, scaffold, or differentiate, the interventions must be appropriate to the learner. The tasks in this study take these theories into consideration in the interventions with the participants. Specifically, the reflection process in the speaking proficiency of participants in this study, who will participate in small and large group discussions, will be reflected in the writing aspects of this study, namely in the comparison between the two writing samples (Vygotsky, 1978).

**Cartooning Assignment 1—Draw Yourself into the Economy (DYE).** What changes—if any—are demonstrated in student writing performances on a Classroom Based Assessment, when brain-based learning strategies are implemented over the span of a research cycle?

For the assignment Draw Yourself into the Economy (DYE), I first went over each of the drawings and recorded what students wrote and drew. I then went over each drawing a second time, looking for themes to emerge. One theme that emerged
during the Draw Yourself in the Economy showed that students chose safe careers, based on their interest and abilities, such as nurse, teacher, graphic organizer, lawyer, restaurant owner, automotive tech, doctor, and television writer. These selections were most likely due to information presented during class, as well as the participants' personal preferences. A theme emerges in the cartooning; formal operational ideas represented no clear ties to the person that made the drawing. This certainly could be a symptom of students not being able to connect with their preoperational thought, particularly noticeable in the writings of the ELL and IEP students.

**Cartooning Assignment 2 – Picture Dictionary.** What changes—if any—are demonstrated in student writing performances on a Classroom Based Assessment, when brain-based learning strategies are implemented over the span of a research cycle?

For the Picture Dictionary (PD) assignment, I first went over each of the drawings and recorded what students wrote and drew. I then went over each drawing a second time looking for themes to emerge. One theme that emerged during the assignment was, that of the six students, two had language levels at the preoperational level. One was an English Language Learner, and the other was on an Individual Education Program with a Special Education Teacher assigned to his progress, throughout his educational career (Piaget, 1959). A trend that emerged in this assignment was that the ELL student and the IEP student respondents scored at the preoperational level, and missed the connection in the debt cycle, to interest accrued on money, lent by an institution (Piaget, 1959). While they understood the process of how individuals enter into a financial agreement with an institution, they failed to draw or label interest
rates. The four neuro-typical people completed the drawings with concrete understanding, and drew and labeled these connections as well (Piaget, 1959).

**Assignment 3 – Cartooning Prompt Based on CBA Question.** What changes—if any—are demonstrated in student writing performances on a Classroom Based Assessment, when brain-based learning strategies are implemented over the span of a research cycle?

In evaluating the assignment Drawing Prompt Based on CBA Question (DBCQ), I first went over each of the drawings and recorded what students wrote and drew. I then went over each drawing a second time looking for themes to emerge. While the students in this study have completed all the steps, much of the language leaves scorers with the impression that many of the students’ claims failed to be backed up by adequate evidence that made sense, through the language they presented in their papers. Especially DM, the IEP student, and JRC, the ELL student, show, through their hollow phrasing as well as borrowed phrases, their inability to make connections to the material I presented. We will see these effects in the student writing sections, further in this chapter.

**Date Source Five – Student Interviews.** What changes—if any—are demonstrated in student writing performances on a Classroom Based Assessment, when brain-based learning strategies are implemented over the span of a research cycle?

From the student interviews I conducted, corroborated by data source 2, video recording, I captured five of the conversations I had with student participants, and encapsulated them. I did not analyze the language of the respondents; I just captured
the conversations in general, and the questions that students were generating. Of the five students I interviewed, their average was 3.33 for the average CBA score, and 3.24 for the claims and evidence score, a significant difference between the average scores on the *You and the Economy* CBA. One respondent from 3rd period was not corroborated as that class was not videotaped. Ultimately the student interviews have been incorporated in the student assignments section.

**Date source six –Cultural Interactions CBA and Economy and You CBA**

**Writing Samples.** What changes—if any—are demonstrated in student writing performances on a Classroom Based Assessment, when brain-based learning strategies are implemented over the span of a research cycle?

Once I scored these essays, I read them all again for this study, in order to note what arguments were made, and I also included the scores. I read them through again with the same definitions from chapter 1, and analyzed the writing through those defintional lenses.

The average score for the Cultural Interactions Essay, that the six respondents turned in prior to the beginning of the study, was 1.92 on a four-point scale. There were no differences between the claims and evidence scores, and the average for the Cultural Interactions Essay. *You and the Economy* essays were scored by the PLC averaged 3.01/4. I isolated the claims and evidence score by focusing on Essential Academic Learning Requirements (EALRs) 2.1.1, 5.2.1, 2.2.1 and 2.4.1, which represent the claims and evidence score, of which the mean was 3.20. The difference between the claims and evidence mean score, and *You and the Economy* mean score, was .19. The average difference between the Cultural Interactions Essay and the You
and the Economy Essay was 1.28. While the average of claims and evidence section was 3.20, that is not a significant movement on the part of student respondents between the claims and evidence scores in *You and the Economy* essay and the average essay score. The significant movement occurs between the Cultural Interactions Essay (class average 1.92) and the *You and the Economy* essay (class average 3.20.) The most significant contributors to this change are the times that occurred between the two writing samples, and the interventions placed during that time frame, including the time frame of this study. Time enough to get better at writing after the first attempt, and to go through the CBA process. Another difference was that during the Cultural Interactions CBA Essay preparation, there was not the detailed prewriting drawing and writing activity that was present in the preparation for the *You and the Economy* CBA.

**Table 1:** Overall Scores, and Claims and Evidence Scores for the Cultural Interactions, and You and the Economy CBAs

<table>
<thead>
<tr>
<th></th>
<th>Cultural Interactions</th>
<th></th>
<th>You and the Economy</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Overall</td>
<td>Claims and Evidence</td>
<td>Overall</td>
<td>Claims and Evidence</td>
</tr>
<tr>
<td>JC</td>
<td>2.3</td>
<td>2.3</td>
<td>3.2</td>
<td>3.2</td>
</tr>
<tr>
<td>RE</td>
<td>2.0</td>
<td>2.0</td>
<td>3.2</td>
<td>3.2</td>
</tr>
<tr>
<td>KG</td>
<td>2.4</td>
<td>2.4</td>
<td>3.3</td>
<td>3.3</td>
</tr>
<tr>
<td>JV</td>
<td>1.7</td>
<td>1.7</td>
<td>3.3</td>
<td>3.2</td>
</tr>
<tr>
<td>DM</td>
<td>1.5</td>
<td>1.5</td>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td>JRC</td>
<td>1.7</td>
<td>1.7</td>
<td>3.8</td>
<td>3.5</td>
</tr>
</tbody>
</table>

What I found in the difference between the scorers, (the three teachers in our PLC), was that the scorers with the most teaching years scored more similarly, than
the one person that had not taught the subject prior. I also noted that the *Cultural Interactions* CBA was a bit more rigorous than the *You and the Economy*, in that it asks respondents to displace themselves a bit further than just themselves and the economy. Displacement is a formal/abstract trait, and exists in *You and the Economy* assignment, in which students are asked to transpose themselves into the future by connecting to past (Hockett, 1960; Piaget, 1959). *Cultural Interactions* CBA asks the student to displace another step further into another community, which adds yet another level of empathetic concern, a formal task in itself. That is what I have been instructed represents best practices in my school district. I have to demonstrate that every year, multiple times, as required by state law.

Ultimately, the students made logical claims and supported them with evidence. The students’ scores for the Cultural Interactions writing, prior to the study, was 1.92. After this study was completed, the average score for *Economy and You* CBA was 3.01. I would have liked to move all learners into the 4, but that did not happen, most likely due to the intervention error by me during the preoperational presentation of the material. Of the six respondents, four matched the criteria of concrete, and two match the preoperational (Piaget, 1959).

**CBA Scores with Piagetian Sociocognitive Levels Analysis.**

What changes—if any—are demonstrated in student writing performances on a Classroom Based Assessment, when brain-based learning strategies are implemented over the span of a research cycle?

DM was a student that scored a 1.47 on the *Cultural Interactions* CBA, a 2.5 on the *You and Economy* CBA, and the same 2.5 on the Claims and Evidence breakout.
For this student, the difference between the two essays was 1.03. For the analysis of this paper, I noted, based on Piaget’s sociocognitive levels, “Shows a preoperational understanding of the defining factors in the economy, and understanding of the technical aspects of nursing.” The student writes:

This field is one of the most interesting and successful in my opinion because of the high amount of jobs that needed to be filled and I will be able to help hurt people and make them better. Physical therapy is such a demanding job because it is one of the few jobs in the world that cannot be relapsed over by robots or overseas.

The language structure is not fully functional, and function of meaning is missing in the writing. In the first sentence shows a preoperational thinker and language user, specifically in the phrase high amount of jobs. This is not a correct usage or even a turn of phrase so this subject matter has not been internalized and he does not understand how it affects his ability to become a Physical Therapist, as he is operating at the preoperational level. As the concrete level, he would need to clearly state those connections, with accurate structure and function in his writing. Some of his language is concrete, but that does not create a formal or abstract notion that he might not be able to actually attain the goal he has set. In the second sentence, he misuses the word relapsed, he means replaced. He saw this on the video, and he has a preoperational level of understanding that he could actually be a PT because he has been a patient of PT his whole life, due to his many physical ailments, which no doubt inhibited his ability to learn and grasp information beyond the preoperational level to the concrete.
JRC, an ELL student, scored a 1.7 on the Cultural Interactions CBA, a 3.76 for You and the Economy CBA average, and 3.5 claims and evidence rubric scores. JRC’s essay shows evidence of a borrowed phrase and reads:

Nationally the automotive industry is facing a difficult if not unprecedented period of competition and capital spending in its efforts to compete with Japanese automakers in order to meet pending government regulations on emissions control and safety. The domestic automotive industry is highly mature, the peaks and troughs in vehicle demand essentially parallel economic activity. Vehicle production in North America is an important part of their total sales, so this makes them highly want more automotive technicians in the auto market industry.

An example of a hollow phrase in JRC’s essay is as follows:

An automotive Technician is located in today’s cars industry as one of the moist important jobs that our country has in the job fields because if offers good paying, full time work benefits, making of this job position even more saturated than the job market for auto dealers. For example, Modern technology has impacted a lot more than we can think of in this case since everything we drive nowadays has technology on them require ring more Automotive technician to help out fix issues on these evolution ate cars.

The hollow and borrowed phrasing suggests this student did not make the gains his CBA score suggests, and has a preoperational grasp of this CBA assignment.

One of the student respondents, JC, scored a 2.3 for the Cultural Interactions CBA, a 3.16 both for You and the Economy CBA, and claims and evidence rubric scores. The difference, for this student, between the two essays was plus .86, or
minimal gains at best. JC, as well as all the others in the study, shows glimpses of formal/abstract thought but the language is not formal/abstract even if the CBA rubric scores at 3 or 4. First, as seventeen or eighteen year-olds, students will naturally fluctuate between formal/abstract and concrete, and even preoperational sociocognitive levels. Second, the CBA rubric, while a formal/abstract tool, is not be able to be completed by students who are not interacting at the formal/abstract level, and thus cannot complete the task without borrowing heavily, such as two of the participants, the ELL and the IEP student, respectively. Similarly, hollow phrases are an indicator that students are not performing at a formal/abstract level, or in the case of the neuro-typical learners, as we are seeing, the abstract is not consistently attainable, just in fits and starts.

JV, a student that scored a 1.7 on the Cultural Interactions Essay, a 3.33 on You and the Economy CBA, had a score of 3.16 on the Claims and Evidence. JV’s Prewrite indicates the use of SEE Statement, and indeed the same SEE Statement on the prewriting was the same idea presented in his final CBA. While JV connected on a concrete level, he shows flashes of formal/abstract, as was also seen in his drawings. At the start of this assignment, he went from Treasure Hunter to Journalist at the end, with a concrete argument as to why he should pursue this path.

RE’s Cultural Interactions essay was scored 2, his You and the Economy, 3.31, and his Claims and Evidence score was 3.16. While his paper makes concrete arguments that help create business opportunities, and puts people to work, he just calls that good, and does not define how that affects others. While RE speaks of recession and how to structure his business to minimize his risk, he is still at the
beginning stages of understanding how that could affect those other than himself who might not own a family business. All of these points speak to a concrete understanding, with some formal/abstract glimpses, of recession and prosperity in the restaurant business that could affect his family establishment. Ultimately, we hope that RE is allowed the experiences of, as he says in his conclusion, “Being my own boss will allow me to run and manage how I feel is necessary.” The larger questions of how to attract and retain an adequate workforce, or any other managerial plans, are not included in this paper and if he were at the formal level, he might include them in this paper.

KG, scored a 2.4 on her Cultural Interactions, a 3.25 on her You and the Economy, and her Claims and Evidence score was 3.3. If KG understood her CBA on a formal/abstract level, she would be able to explain how her presence, and law specialty, could assist specific clients in resolving their conflicts. However, the lack of her preoperational understanding also comes through, as she is not able to describe, in the paper, the steps she will need to become a lawyer, and to own her own business, and what type of business that is. She is on her way to state university and is one of the brighter students in school. I have had KG as a sophomore in my general world civilization course and her writing and thinking has improved, but she still is not making the connections at a formal level. While her drawings and writing show glimpses into formal/abstract as much as any of the other students, the ability to sustain this thought in writing for the task of the CBA was difficult for her and the rest of the respondents.
Limitations

I recognize that a more preoperational intervention would have been to start class with a preoperational prompt that asked students to list the items they had in their pockets. Then ask them to respond to the who, what, when, where, how, and why, of the items to explain the items’ personal or preoperational connection to the learner, the concrete, how it affects those around the learner, and the formal/abstract, how those concrete concepts interact to form the ideal systemized definitions which society places on persons places and things in the form of language.

The initial question for the drawing prompt was a formal question, “Draw yourself into the current economy,” and was the prompt that I assigned students to complete in class, on an 11x17 piece of paper. While the questions to answer on the backside of the 11X17 were preoperational, and the students answered them as such on the back of the DYE assignment, the drawing prompt was a formal question, and this was a mistake on my part which influenced the study. This, in turn, reduced their ability to make connections to the material and contributed to the hollow phrases and borrowed language in both of these learners' final CBA. Four of the respondents are neuro-typical, and the drawings, in their cases, were preoperational as well. This makes sense, as the question was to solicit a preoperational response, so the students could directly tie to the material. A better way to do this would be to ask each of the students to make a list of the items they brought to class and then have them draw the connections of who, what, when, where, how, and why, in cartoon style, so the students could see the personal connections to the economy that they have. This explains the inability for these four neuro-typical learners to reach the formal level,
continue to stay at the concrete, and fail to make the larger connections in their papers that were seen in the answers to the second question.

Ultimately, because I did not correctly facilitate their cartooning interventions, the participants may have missed these preoperational connections that build into concrete, and then formal/abstract after they are refined. While I refined them in a number of ways, the cartooning left much to be desired in the way of true preoperational, sociocognitive building that would have required a personal question, such as, describe what you have in your pockets and then made the who, what, when, where, how, and why, connections to each of their items that could have tied them to the global economy. Once students make connections from their items to the world and back, students’ thought is refined enough to begin to make preoperational understanding. Building directly upon living experience to bring to bear on the learning environment and the language, students’ use in context with others allows them to collectively grasp formal thought. Once that happens, the writing clears up, there are fewer or no hollow phrases and borrowed phrases become obsolete. From the results of the CBAs, most of the students need ample practice and glimpses of formal/abstract thought, repeatedly throughout their formative brain development years, until they reach 23-25, and then adulthood settles in with its epochs of human development.

This cartooning assignment lacked the depth to engage the students, as these were formal concepts again without making a preoperational connection (Piaget, 1959). Students failed to create inner meaning, especially JRC, an ELL student, and DM, both IEP students. Their scores indicate they are still existing in a preoperational
language state that will not allow them to access the world through their brains, and will at least continue to make things hard for these students in understanding their surroundings (Piaget, 1959). We also see this through the lack of originality in the drawings. Even though I elicited responses from the classroom, and many students were involved, others were not, and when they came back from that transition, many were lost as to how to complete the drawing, as the concepts were formal, and given in a formal manner through the video. The students needed the information to connect directly to them, in order for those students to begin to acquire meaning through an accurate understanding of how to use their language abstractly, in describing scenarios and actions in the future, and, as a result of their actions—abstract thought.

A more effective manner of cartooning would have been to use the preoperational drawing from DYE assignment, to have each learner then discover, through their own drawings, what concepts they needed to define, as the preoperational nature of the drawings would have revealed the missing links between who, what, when, where, how, and why, of each of the concepts which the students are studying, related to completing the formal task of the CBA writing. The lack of true preoperational cartooning failed to allow the cartooning to truly reach each of the students at their preoperational level, where new learning connections are made, so they could make the concrete, and then formal/abstract connections they needed in order to score well on the CBA rubric. We will confirm this with the scores. The formal/abstract information given via video, and then connected via student conversations, as well as my I stories were not enough to compensate for the lack of visual connections to the preoperational. These were essentially formal operational modifications that failed to
reach learners at a preoperational level, as we will see in the scoring of the *You and the Economy* CBA.

Also, because these students need much more scaffolding them I can offer them due to time constraints, and the fact that this method is not in place at other points in the six respondents' lives, they did not progress as far as I thought they would. Another finding is that I might have completed the preoperational part of the procedures sections in another manner. Add the truly preoperational connections directly to students during the first five days of the study rollout, and scaffold off those personal drawings, based on items they brought to school, rather than what scaffolding the class needs as a whole, through call and response discussions, which can be formal for many students, but nor preoperational or concrete enough for others to grasp. More life experience is needed for most of these 18 year-olds to get to 23-25, before they are fulltime formal operational adults (Baars & Gage, 2010).

**Future Research Needed**

Future research in this area would take the form of specific modifications of the preoperational presentation of material to the participants. Other interventions in this research area could constitute looking further at each of the cartooning assignments, to observe specific assignments and their effectiveness in delivering the brain-based interventions that are so needed in education. More specifically, in examining the Picture Dictionary assignment, that task could be modified to contemplate different aspects of drawing, as compared to writing on a standardized. The merit of designing curriculum within an emerging field, which is based on the interpretation of the scaffolder, requires frequent publication in order to speed further
discussion, and more publication on these cognitive psychology theories as carried out by teachers in secondary school houses in the world.

**Implications for Practice**

Cognitive psychology is a basis for a new interpretation of constructivist literature based on how the brain is organized. Publication, dissemination, and discussion from research of teaching writing in secondary schools, will inform any educator that is interested in how these brain-based interventions can help scaffold adolescent learning. Theories that can inform educators about how best to reach adolescents are based on sound research, that shows ways in which to best reach this population.

**Concluding Summary**

The purpose of this study was to investigate whether the use of brain-based pre-writing strategies will improve students’ abilities to support claims, with evidence, on a state mandated classroom-based assessment. Specifically, the research evaluated the working hypothesis that using brain-based, pre-writing activity in the non-fiction, expository writing process will assist students in their performances, as assessed by the Office of the Superintendent of Public Instruction for the state-approved *You and the Economy* CBA CBA Rubric. By using brain-based strategies as a pre-writing activity in the non-fiction, explanatory, secondary social studies writing process, I hypothesized that those students would demonstrate logical use of claims and evidence in their typed essays.

**Research Overview**

This research study was guided by two overarching research questions:
1. As brain-based learning strategies are being implemented in real time, what is the nature of the process of using brain-based interventions? In documenting the brain-based interventions, what decision-making factors are considered when designing the unit of instruction?

2. What changes—if any—are demonstrated in student writing performances on a Classroom Based Assessment, when brain-based learning strategies are implemented over the span of a research cycle?

These research questions were answered through a research design involving a cycle of instruction, which culminated in an explanatory writing sample. The research used cognitive psychology theories to refine learners' concepts, and to promote learning, which will improve students' ability to make claims, and provide proper evidence for those claims, as measured by the Office of the Superintendent of Public Instruction for the State approved *You and the Economy Class Based Assessment (CBA)* Rubric. The process of my decision making as well as student assignments and writing samples were examined to evaluate the effect of brain-based pre-writing strategies students use to complete the CBA.

Most importantly this study shows students learn and grow, no matter the obstacles, even the unintentional ones that educators place in their paths. I have seen it time and time again, and that is why we teach. Some days of this study were phenomenal, others desperate. All interventions were done with the best intentions on my part, and to increase understanding of students through accessing their acoustic, kinesthetic, and visual patterns, to name concepts with language, thus raising thinking. This is difficult for the system of public education. All my students are special, and
each must have a voice in this world. When they concluded this study, we see that those who participated contemplated ideas inside themselves they could connect to their families, their communities, and the world at large. They did that, and they completed a writing task in the process. While they have made these kinds of connections to the world, and will do that in the future, it was important, at that time and place, that we got together and completed these tasks. Education is built on the shared work of allowing students access to their world, as well as the world around them because that is how people learn.
References


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Appendix A Common Core Standards & WA State Standards

The Common Core Standards that will be covered in this unit are as follows:

Key Ideas and Details: CCSS.ELA-Literacy.RH.11-12.1, Cite specific textual evidence to support analysis of primary and secondary sources, connecting insights gained from specific details to an understanding of the text as a whole; CCSS.ELA-Literacy.RH.11-12.2, Determine the central ideas or information of a primary or secondary source, provide an accurate summary that makes clear the relationships among the key details and ideas; CCSS.ELA-Literacy.RH.11-12.3, Evaluate various explanations for actions or events and determine which explanation best accords with textual evidence, acknowledging where the text leaves matters uncertain. Craft and Structure: CCSS.ELA-Literacy.RH.11-12.4; Determine the meaning of words and phrases as they are used in a text, including analyzing how an author uses and refines the meaning of a key term over the course of a text; CCSS.ELA-Literacy.RH.11-12.6; Evaluate authors' differing points of view on the same historical event or issue by assessing the authors' claims, reasoning, and evidence. Integration of Knowledge and Ideas: CCSS.ELA-Literacy.RH.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, as well as in words) in order to address a question or solve a problem. CCSS.ELA-Literacy.RH.11-12.8, Evaluate an author's premises, claims, and evidence by corroborating or challenging them with other information. CCSS.ELA-Literacy.RH.11-12.9, Integrate information from diverse sources, both primary and secondary, into a coherent understanding of an idea or event, noting discrepancies among sources; Range of Reading and Level of Text
Complexity: CCSS.ELA-Literacy.RH.11-12.10 By the end of grade 12, read and comprehend history/social studies texts in the grades 11-CCR text complexity band independently and proficiently.

**WA State Standards**

The State GLE (EALR) that are followed: 5.4.1 Evaluates positions and evidence to make own decisions in a paper or presentation; 5.1.1 Analyzes the short-term and long-term implications of decisions made affecting the global community; 5.1.2 Evaluates the plausibility of an analysis of decisions affecting the global community; 2.1.1 Analyzes how economic choices made by groups and individuals in the global economy can impose costs and provide benefits; 5.2.1 Evaluates the plausibility of an analysis of implications of decisions for the global community; 5.3.1 Evaluates how the discussion and the proposed alternative resolutions changed or solidified one’s own position on public issues; 2.2.1 Analyzes and evaluates the advantages and disadvantages of different economic systems for countries and groups of people; 2.2.2 Analyzes and evaluates the effects of specialization on global trade; 2.4.1 Analyzes and evaluates how individuals affect and are affected by the distribution of resources and sustainability; 5.4.2. Creates strategies to avoid plagiarism and respects intellectual property when developing a paper or presentation; 5.2.2 Evaluates the validity, reliability, and credibility of sources while researching an issue or event. 5.2: Uses inquiry-based research; and 5.4 Creates a Product.
Appendix B Student Data

District Data: The participating school employs 68 of the district’s 1,206 classroom teachers, and the state’s 59,002, with an average 11.6 years in service compared to the district’s 12.4 years of service, and the state’s 13.9 years in service. 78% have master’s degrees compared to the district’s 74.3%, and the state’s 68.2%, and 100% are Elementary and Secondary Education Act (ESEA), highly qualified,

<table>
<thead>
<tr>
<th>Student Demographics</th>
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</thead>
<tbody>
<tr>
<td><strong>Enrollment</strong></td>
</tr>
<tr>
<td>October 2014 Student Count</td>
</tr>
<tr>
<td>May 2015 Student Count</td>
</tr>
<tr>
<td><strong>Gender (October 2014)</strong></td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td><strong>Race/Ethnicity (October 2014)</strong></td>
</tr>
<tr>
<td>Hispanic / Latino of any race(s)</td>
</tr>
<tr>
<td>American Indian / Alaskan Native</td>
</tr>
<tr>
<td>Asian</td>
</tr>
<tr>
<td>Black / African American</td>
</tr>
<tr>
<td>Native Hawaiian / Other Pacific Islander</td>
</tr>
<tr>
<td>White</td>
</tr>
<tr>
<td>Two or More Races</td>
</tr>
<tr>
<td><strong>Special Programs</strong></td>
</tr>
<tr>
<td>Free or Reduced-Price Meals (May 2015)</td>
</tr>
<tr>
<td>Special Education (May 2015)</td>
</tr>
<tr>
<td>Transitional Bilingual (May 2015)</td>
</tr>
<tr>
<td>Migrant (May 2015)</td>
</tr>
<tr>
<td>Section 504 (May 2015)</td>
</tr>
<tr>
<td>Foster Care (May 2015)</td>
</tr>
<tr>
<td><strong>Other Information</strong> (more info)</td>
</tr>
<tr>
<td>Adjusted 4-Year Cohort Graduation Rate (Class of 2014)</td>
</tr>
<tr>
<td>Adjusted 5-year Cohort Graduation Rate (Class of 2013)</td>
</tr>
</tbody>
</table>

compared to the district’s 98.8%, and the state’s 96.5%, 49 teachers, teach 401 core academic classes compared to the district’s 1,158 teachers that teach 6,251 core
academic classes, and the state’s rate of 59,002 teachers teaching 244,354 core academic classes.
Appendix C Observer Data Collection Sheets

Observation/Video Recording Form & Evaluation Criteria

Observer: ________________________________
Date: ____________________________

Lesson Focus: ________________________________

<table>
<thead>
<tr>
<th>Time</th>
<th>Description of Events</th>
</tr>
</thead>
</table>

The Teacher Evaluation Project TPEP developed by University of Washington and the 5 Dimensions of Teaching and Learning will be used as a basis to observe my teaching practices during the observations of high school teachers, administrators and UP Graduates to make sure the practices I detail in the study are actually happening as I claim. This is an extra protection and measure of integrity for this study to offset possible bias in observing and reflecting on my own practice.
State Observation Criteria

SE1 Intellectual Work Quality of questioning.
State Criteria: Demonstrating effective teaching practices

SE3 Engagement Strategies High cognitive demand.
State Criteria: Centering instruction on high expectations for student achievement.

SE5 Engagement Strategies Expectation, support and opportunity for participation and meaning making.
State Criteria: Demonstrating effective teaching practices

CP2 Teaching Approaches &/or Strategies Discipline-specific conceptual understanding.
State Criteria: Providing clear and intentional focus on subject matter content and curriculum.

CP3 Teaching Approaches &/or Strategies Pedagogical content knowledge.
State Criteria: Providing clear and intentional focus on subject matter content and curriculum.

CP6 Scaffolds for Learning Scaffolds the task.
State Criteria: Demonstrating effective teaching practices

P3 Teaching Point Teaching points(s) are based on students’ learning needs.
State Criteria: Recognizing individual student learning needs and developing strategies to address those needs.

Theory Description

Piaget, Vygotsky, Lenneberg and Bruner describe students developing questioning in adolescence that guides their learning.

Vygostsky’s Zone of Proximal Development allows for learners to engage just beyond their level of understanding. This is also backed by the Piaget accommodation and assimilation theory.

Student talk found in Piaget, Vygotsky, Bruner and Pulvermuller allows students to self-examine and understand deeper their concepts through language based learning.

Concepts are formed by language based social interaction (Vygostsky) with peers in the classroom, as well as in writing about classroom topics and receiving cognitive feedback from the instructor (Piaget). New knowledge is added and refined to add to understanding creating new meaning for the learner (Piaget, 1959).

Sociocognitive understanding of the learner rooted in Piaget, Vygotsky and Lenneberg the classroom and what level they are understand the material based on the language they use to link claims to evidence.

Bruner, scaffolding exists based on the individual learner to get them to the
next sociocognitive level (Piaget, Vygotsky, and Lenneberg).

Learner’s needs will emerge throughout the sociocognitive (Piaget, Vygotsky, and Lenneberg) learning process for every learner; at his or her own pace, scaffolding is so important.
Appendix D Visual Conference Protocol

These conferences occur regularly in the classroom, and are used to support students in elaborating on the meaning of their drawings. Audio recordings of conferences with students will be made during class and transcribed with a pseudonym on the Visual Conference Analysis Form (below).

The conferences between the teacher-researcher and students will include these questions:

   Tell me about your drawing.
   Who is in your drawing?
   What is going on in your drawing?
   When is this happening?
   Where is this happening?
   Why is this happening?
## Appendix E Visual Conference Analysis Form

Participant Pseudonym: ______________________________ Date: __________________

<table>
<thead>
<tr>
<th>Question</th>
<th>Transcribed Student Response</th>
<th>Categorization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tell me about your drawing.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Who is in your drawing?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What is going on in your drawing?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>When is this happening?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Where is this happening?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Why is this happening?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Initial categories for interpreting student responses include displacement, productivity, flexibility, semanticity and redundancy. Other codes will be added through an inductive process. Linguists refer to displacement, or the understanding that ideas are separate from the physical existence of a person, allows communication with others over time and space (Hockett, 1960). Semanticity in linguistics refers to the overlapping of meaning, created from experiences layered with language which name concepts that offer more complex meanings to be shared about higher order thoughts (Hockett, 1960). Flexibility is the linguistic ability to communicate with others about a variety of concepts that can be used in a variety of different setting and ways (Deak, 2004). Productivity, concepts mean similar ideas in spoken or written form and concepts are understood through drawing, numeracy, writing or speaking (Hockett, 1960). Redundancy, concepts increase in learning to a point where they can synthesize with others and form specific and efficient messages to others, from their synthesizing of multiple concepts (Hockett, 1960).
Appendix F CBA Rubric:

Office of the Superintendent of Public Instruction for the State approved *You and the Economy Class Based Assessment* (CBA) Rubric. Students’ work will be blind scored with student numbers. In order to create inter-rater reliability, a colleague and I both trained in State CBA will independently grade each essay. If there is more than a point difference between raters a third grader, also trained in the State CBA will step in to rate the student’s essay. This rubric was approved by OSPI since 2008 and is backed by eight different State Grade Level Expectations (GLE) or Essential Academic Learning Requirements (EALR) and is used in related studies to measure student writing.

Requirements for the *You and the Economy* CBA written specifically for State 12th graders says: Responsible citizenship requires careful consideration of the role people play in the local, national and global economy. Evaluate the career choices available to you, and their possible effects on your local, national and international economy, as well as yourself. In a cohesive paper or presentation, you will: State a position on which career choices would be best for you. Provide reasons for your position that include: An analysis of how your career choices will affect the local, national, and/or global economy with one or more examples. An analysis of how the economic system may affect your economic choices with two or more examples. An analysis of how economic system may affect your economic choices with two or more examples. Make explicit references within the paper or presentation to three or more credible sources that provide relevant information and cite sources within the paper, presentation or bibliography.
According to OSPI a score of 4 will denote an Excellent paper or presentation that States a position on which career choices would be best for the student that includes an analysis of what the student’s career options tell us about the global economy. Provides reason(s) for the position supported by evidence including an analysis of how the student’s career choices will affect the local, national, and/or global economy with two or more examples. The evidence for the position includes an analysis of how the economic system may affect the student’s economic choices with two or more examples and an analysis of how the distribution of resources or issues of sustainability in the global economy affect the student’s career choices. Makes explicit references within the paper or presentation to four or more credible sources that provide relevant information in which citation of sources within the paper, presentation, or bibliography are identified and correctly categorized according to APA Style.

A score of 3 or Proficient will state a position on which career choices would be best for the student. Providing reason(s) for the position supported by evidence including an analysis of how the student’s career choices will affect the local, national, and/or global economy with one example. The evidence for the position includes an analysis of how the economic system may affect the student’s economic choices with two or more examples making explicit references within the paper or presentation to three credible sources that provide relevant information citing sources within the paper or presentation APA Style. A score of 3 or 4 is passing.
A score of 2, Not Passing or Partial states a position on career choices without indicating which would be best for the student. Provides reason(s) for the position supported by evidence including an analysis of how the student’s career choices will affect the local, national, and/or global economy without specific examples. The evidence for the position includes an analysis of how the economic system may affect the student’s economic choices with one example. Student makes explicit references within the paper or presentation to two credible sources that provide relevant information. Citation of sources within the paper or presentation APA Style.

A score of 1, Not Passing or Minimal states a position on career choices without taking a position. Mentions how the student’s career choices will affect the local, national, and or global economy without an analysis. The evidence for the position includes an analysis of how the economic system may affect the student’s economic choices without specific examples. Making explicit references within the paper or presentation to one credible source that provides relevant information. Citation of sources within the paper or presentation is to be done APA Style.

The following rules apply when scoring any of the Social Studies Classroom Based Assessments (CBAs) for grades 6-12. Position: All CBA responses should include a position. In some cases, such as the “Constitutional Issues” CBA, this position is meant to be persuasive. For other CBAs, such as the “Enduring Cultures” CBA, it is the well reasoned conclusion that the student has drawn about the cultures being examined. In both cases, however, the response must do more than simply
restate information. Instead, every CBA response should make a case or argument for looking at a particular issue, topic, or event in a particular way.

Explanation and Analysis for Background, Reasons, or Evidence: Any required explanation or analysis should include at least one specific detail or example as well as the student’s commentary on how the detail or example relates to the position, issue, or topic being addressed in the CBA response. Just providing commentary or just listing specific details is not adequate to earn a response credit for explaining or analyzing something.

Sources: All CBAs for grades 6-12 require responses to use and cite 3 or more sources. To be credited for the use and citation of a source, the response must explicitly address the source within the text and provide enough bibliographic information so that an outside reviewer could find the source (e.g., author, title, and url for an online article) or, at least, be able to corroborate the existence of the source (e.g., informal interviews). The only source for which a student does not need to provide bibliographic information is the U.S. Constitution.

A.C.C.E.: There are four qualities that any CBA response must have to earn credit. In short, they must be accurate, clear, cohesive, and explicit in addressing the relevant concepts. Cohesive, all parts, paragraphs, or sections of a CBA response must fit together in one cohesive whole. If it is so disjointed that an outside reviewer would not be able to gather the overall position, it cannot earn credit. Clear, if an outside reviewer cannot follow the points made in a CBA response due to lack of clarity, it cannot be credited. Explicit, responses should address concepts and elements required by the rubric in explicit terms. For example, if the rubric requires the response to
include a discussion of a particular perspective, it should be clear to an outside reviewer where that discussion is in the response. Credit should not be given to points that require inferences to be made. Accurate, for a response to earn any credit, the information provided for a particular criterion must be accurate.

Claims and evidence for each paper will be analyzed through the Rubric especially 2.2.1 Analyzes and evaluates the advantages and disadvantages of different economic systems for countries and groups of people. 5.2.2 Evaluates the validity, reliability, and credibility of sources while researching an issue or event

OSPI Statement on Economy and You CBA:

According to OSPI the validity, coherence, balance, research, integration, and accountability are listed as cornerstones for the use of the CBA in classrooms for best practice. The information below was taken straight from the OSPI website.

Validity: Given the broad, conceptual nature of our Social Studies EALRs, the OSPI-Developed Social Studies Assessments are a valid way to assess the learning of these standards and to help students gain the knowledge and skills authentic to engaged, informed citizenship. A more standardized form of assessing social studies learning (e.g., multiple-choice and short answer questions) would not have the same validity.

Coherence: District social studies programs will have greater coherence if OSPI-Developed Social Studies Assessments are included in each of their history, civics, geography, and economics courses from grades 3 through 12. The common rubrics ensure that students will be asked to meet similarly rigorous expectations as they move from grade to grade, as well as from district to district.
Balance: The OSPI-Developed Social Studies Assessments are designed to ensure accountability to the state’s standards while still maintaining a local district’s control over specific content in social studies.

Research: There is a great deal of research that indicates that having students engage regularly in rigorous, authentic, performance-based assessments, such as the OSPI-Developed Social Studies Assessments, increases their academic achievement in social studies and overall. The research by Cathy Taylor (2005) in Classroom assessment: Supporting teaching and learning in real classrooms. On classroom-based assessments has informed the development of the OSPI-Developed Social Studies Assessments as has the research of Fred Newmann (1990). Five standards of authentic instruction and his associates on authentic intellectual work.

Integration: The Social Studies OSPI-Developed Social Studies Assessments are another way teachers can target important reading and writing standards in their instruction.

Accountability: The OSPI-Developed Social Studies Assessments and the reporting on the use of these assessments are one way the state is asking districts to ensure that all students have opportunities to meet the standards in civics, economics, geography, history, and the social studies skills.

The CBA gets its validity from the broad, conceptual nature of our Social Studies EALRs, the Social Studies Assessments are a valid way to assess the learning of these standards and to help students gain the knowledge and skills authentic to engaged, informed citizenship. A more standardized form of assessing social studies learning
(e.g., multiple choice and short answer questions) would not have the same validity. The CBA is researched based that indicates that having students engage regularly in rigorous, authentic, performance based assessments, such as the CBA, increases their academic achievement in social studies and overall.

Furthermore the OPSI website states:

The CBA and the reporting on the use of these assessments provides accountability and ensure the state is asking teachers to ensure that all students have opportunities to meet the standards in civics, economics, geography, history, and the social studies skills. CBAs allow for coherence between district social studies CBAs are included in each of their history, civics, geography, and economics courses from grades 3 through 12. The common rubrics ensure that students will be asked to meet similarly rigorous expectations as they move from grade to grade, as well as from district to district. The CBAs are designed to ensure accountability to the state’s standards while still maintaining a local district’s control over specific content in social studies. Common Core State Standards for English Language Arts provide an integrated model for literacy in history and other social studies disciplines. Guided by teachers, students will gather, comprehend, evaluate, synthesize, and report on information and ideas. Conduct original research in order to answer questions or solve problems. Analyze and create a range of print and nonprint texts in media forms both old and new.

The Social Studies CBA integrates EALRs so teachers can target important reading and writing standards in their instruction. The specific EALRs that will be targeted to look at claims and evidence in this research are specifically in expository essay
number one Cultural Interactions, 2.2.1 Analyzes and evaluates the advantages and disadvantages of different economic systems for countries and groups of people. 5.2.2 Evaluates the validity, reliability, and credibility of sources while researching an issue or event. 3.2.2 Analyzes the social and political factors affecting cultural interactions.

The EALRs specifically addressed in You and the Economy: 2.2.1 Analyzes and evaluates the advantages and disadvantages of different economic systems for countries and groups of people. 2.4.1 Analyzes and evaluates how individuals affect and are affected by the distribution of resources and sustainability. 5.2.2 Evaluates the validity, reliability, and credibility of sources while researching an issue or event. 2.1.1 Analyzes how economic choices made by groups and individuals in the global economy can impose costs and provide benefits. 5.2.1 Evaluates the plausibility of an analysis of implications of decisions for the global community. Bolded EALRs are shared by both assessments.

CBA’s in our CWP Professional Learning Community (PLC) are blind scored with student numbers. In order to create inter-rater reliability two colleagues and myself, all trained in State CBA will independently grade each essay. If there is more than a point difference between raters, a third grader, also trained in the State CBA steps in to rate the student’s essay. During the last three years our CWP PLC has identified trends in student’s’ responses to the CBA’s. In discussing our students over the years in our problem areas are making claims and using proper evidence to back those claims. We notice that in the past, the problem statement scores were overwhelmingly passing the state rubric, as were the citation scores, while the content or analyzing claims and
evidence scoring sections were significantly lower than the other two areas on the state rubric.