DISSERTATION

APPLICATION OF BRAIN-BASED LEARNING THEORY FOR COMMUNITY COLLEGE DEVELOPMENTAL ENGLISH STUDENTS: A CASE STUDY

Submitted by

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WE HEREBY RECOMMEND THAT THE DISSERTATION PREPARED UNDER OUR SUPERVISION BY CHRISTINE M. GETZ ENTITLED APPLICATION OF BRAIN-BASED LEARNING THEORY FOR COMMUNITY COLLEGE DEVELOPMENTAL ENGLISH STUDENTS: A CASE STUDY BE ACCEPTED AS FULLFILLING IN PART REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY.

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ABSTRACT OF DISSERTATION

APPLICATION OF BRAIN-BASED LEARNING THEORY FOR COMMUNITY COLLEGE DEVELOPMENTAL ENGLISH STUDENTS: A CASE STUDY

This mixed method study examines the presumed effect of incorporating curriculum using brain-based principles for under-prepared community college students in their developmental English classes. For the study, the researcher and two other developmental English instructors designed and presented at least one brain-based lesson to developmental English classes.

Semester gain scores on a writing sample, a survey of attitude towards writing, and a survey of comfort with the writing situation of the three brain-based classes were compared with those of four non-brain-based classes. All seven classes showed significant gains on the three measures with no significant difference between the two groups. The results are attributed to (1) college composition classes naturally using strategies consistent with brain-based theory, (2) two instructors approaching brain-based theory as novices, and (3) limited number of brain-based lessons.

Three instructors and nine students were interviewed three times during the semester. Instructors spoke of their experiences with successful strategies and challenges in working with developmental English students and their challenges as well as their evaluation of the brain-based methods they employed. The students, who were not aware of the brain-based lessons, were asked to describe the best type of instruction for them and the effectiveness of the instruction for their English course.

Strategies identified by faculty as effective were compatible with brain-based learning theory with the exception of the concepts related to actually physical brain function such as growth of dendrites with learning and destruction of brain cells in response to stress. Similar to the research, student responses suggested a nonreflective attitude toward their learning. While instructors encourage students to be active learners, students identified instructor explanation as their preferred delivery of content.

Two themes emerged from the interviews. Faculty and students both were dealing with change: change of instructional method and in meeting the academic demands of college. The tensions between behavioral and constructivist learning theory and method as well as accountability issues in the developmental classroom imposed some instructional restrictions.

Further research is recommended in methods relating the physiology of learning to classroom instruction as a way to take advantage of the brain's natural attention and memory systems.

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DEDICATION

This dissertation is dedicated first to my husband Tom who has been a source of encouragement and support throughout.

I would also like to dedicate this dissertation to developmental educators and students who strive to make the world a better place through education, and especially to the memory of Kendrick Lackey whose enthusiasm for learning made him the kind of student who inspires those of us who hope to create an environment in which our students can make a difference in their lives.

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As a member of the faculty at Pikes Peak Community College and through my work with community college students, I know that education can change lives. Besides achieving my dream of a PhD, I have emerged a different person than I began. I would like to thank many people for their help and inspiration in my graduate school experience.

First, my advisor, Dr. Robert Richburg, has been a patient and knowledgeable guide throughout the process. Other members of my committee have offered their support and wisdom. Thank you to Dr. Jean Lehmann, Dr. James Banning, and Dr. Michael Palmquist for recommending a qualitative component in this study, and to Dr. James Banning for his knowledgeable, kind, and patient feedback on this "work in progress."

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CHAPTER 1: INTRODUCTION

Problem Statement and Context

The following passage was written by a community college student, Mica, who enrolled in a developmental English class with hopes of overcoming past inadequacies in her writing.

> "Being in a college English class I felt I was final going to learn something about this word call English. All through high school I felt so insure about writing, I always felt someone know my secret and they were calling me dumb behind my back. I felt a little dumb but, I knew someday I will learn were to put a period, comma, and a semicolon without feel unsure about it. So, in college I felt this is when every thing is going to change. I knew I was going to learn everything I always want to learn it made me feel good." (cited in Harley & Cannon, 1996, p. 80)

Not unlike other students, Mica began her college career optimistically. By the end of the semester, however, both she and her instructor experienced frustration when, after much effort, her writing still did not meet the expectations of the class. According to her English instructor,

> That intensive one-on-one tutoring from peers and instructors, diagnostic analyses of her patterns of error, comparisons of her own patterns to typical nonstandard patterns of Black English Vernacular, and extensive opportunities for revision did not help Mica gain greater power over spelling, punctuation, and syntax remains one of our greatest puzzles. (Harley & Cannon, 1996, p. 80)

Mica, other developmental English students like her, and developmental English instructors find themselves at a time of great need for an educated society, with increased access to higher education for people who had previously not considered going to

college, and with dedicated instructors who have access to knowledge of a variety of learning strategies. In a country that values education and makes it accessible to so many, it is frustrating to be faced with a willing student such as Mica and not be successful.

To help under-prepared students succeed, community colleges provide support services, including developmental (also called "remedial") instruction to bring students' skills up to the level necessary for success in college work. However, developmental students have a high dropout rate. In his national study of developmental education, McCabe (2000) found that only 43% of developmental students completed their programs. While students who successfully complete developmental courses go on to succeed in college at the same rate as those not requiring developmental courses (Boylan, 1985; Roueche & Roueche, 1999a, 1999b; Roueche, Roueche, & Ely, 2001), legislators concerned about the low success rate of under-prepared students in developmental courses question the efficacy of providing financial support (Boylan, Bonham, & Bliss, 1994; Cloud, 2002; McCabe, 2000; Roueche & Roueche, 1999a, 1999b).

Because of the poor retention rate of developmental students and emphasis on outcomes and accountability from legislators, community colleges look for methods that will improve the success rate of developmental students. Community college instructors are sensitive to the needs of their students and usually make every effort to meet their learning needs. Developmental instructors are especially aware of the importance of not only teaching facts and skills, but also in helping students develop learning strategies that will enable them to succeed in their academic endeavors. Learning styles, multiple intelligences, metacognitive strategies, situated cognition, mediated learning, use of

technology, and learner-centered instruction are among the methods and strategies devised to help students become active learners and processors of information.

In the last twenty years, information on how the brain processes information has found its way into educational theory and may offer strategies addressing the needs of under-prepared students. Application of brain-based learning strategies is new territory that may provide insights about learning that will enable instructors to help their struggling students become successful. According to brain-based learning theory, teaching and learning can be enhanced when curriculum is developed with knowledge of the way the brain places its attention and receives and processes information.

Smilkstein (1998) believes that brain-based strategies in the classroom enable students who have been turned off by the traditional educational setting to succeed. Sylwester (2000) agrees that, while at times the application of brain-based theories is elusive, its principles facilitate the learning process. Caine and Caine (n.d.) caution that what we are learning about the brain from neuroscience needs to be considered along with other disciplines such as psychology and cognition.

Others such as Bruer (1998) maintain that the neurosciences have nothing to offer us in classroom application at this time; that rather than bringing a unique perspective, brain-based learning theories are a compilation of strategies that have proven effective over the years. It's just that now we have a biological explanation as to why and how those strategies work so well. Among brain-based learning strategies that have previously been recognized in learning theory are active learning (Bruner, 1960; Caine & Caine, 1997; Dewey, 1897; Jensen, 1998; Johnson, Johnson, & Smith, 1998), cognitive and metacognitive strategies (Caine & Caine, 1997; Feuerstein, 1980; Kolb, 1984;

Shaughnessey, 1977; Sylwester, 2000), collaborative learning (Bruffee, 1984; Caine & Caine, 1997; Jensen, 1998; Smilkstein, 1998; Sylwester, 2000), learning styles and multiple intelligences (Gardner, 1993; Dunn & Dunn, 1978; Kolb, 1984), schema theory (Bruner, 1960; Davis, 1991 b; Piaget, 1977; Smilkstein, 1998; Vgotsky, 1978), self-directed learning (Caine & Caine, 1997; Cooper, 1993; Sylwester, 2000), and social and transformational learning (Chickering & Reisser, 1993; Cross, 1992; Freire, 1986; Meizerow, 1981).

To begin exploring the application of brain-based learning theories in the community college classroom, two developmental English instructors embarked with me on a journey to promote the application of brain-based theory in developmental English classes at the college. We each identified areas in our English 060 level writing classes that we wanted to improve and developed instruction using brain-based strategies.

The purpose of this mixed method case study is to discover the presumed effect of integrating curriculum using brain-based principles in English 060 classes at Pikes Peak Community College. The inclusion of instruction using brain-based principles will be examined from the perspectives of faculty and selected students and from the anticipated improvement of student performance as measured by pre- and post-semester writing samples and a two-part attitude-toward-writing survey. The case study methodology will provide rich textual evidence of the faculty and student perception of instructional methods in the English classes.

Research Problem

This case study explored the application of the concepts of the brain-based learning ("brain-compatible learning" and "the natural human learning process") as

conceptualized by Caine and Caine (1994), Davis (1997), Hart (1992), Jensen (1996, 1998), King (1997), Kotulak (1996), Posner and Raichle (1994), Smilkstein (1993, 1995, 1998, 1999), and Sylwester (1995, 2000) for instruction of developmental English students.

Research Questions

Through quantitative measures, the study attempts to answer the question: Will curricula developed according to principles of brain-based learning result in significant change in students' writing as measured on pre- and post-semester writing samples and surveys of attitude toward writing and comfort with the writing process compared to students whose classes did not intentionally incorporate brain-based activities?

The study also addresses four questions through student and faculty interviews: (1) How can instruction for developmental English classes (English 060 at Pikes Peak Community College) be designed according to the concepts of brain-based theory; (2) How will students and faculty respond to that instruction; (3) What do instructors identify as the most significant learning components of brain-based instruction, and would instructors perceive that brain-based instruction differs significantly from other instructional models using similar delivery methods; and (4) If so, do those contribute positively to the success of students from the perspective of faculty and students?

Through analysis of interviews of faculty and selected students, the study also hopes to discover the answer to the following question: When faculty and students discuss their experiences in their English 060 classes, what themes emerge, and how do those themes relate to brain-based learning concepts and strategies?

Theory

The theory used in the instructional design is brain-based teaching and learning. This theory has come from new research on brain functioning acquired over the past twenty years (Sylwester, 1995) with the development of technology that is able to study the brain, and especially since 1990, the Decade of the Brain (Howard, 1994). Brain-based learning has been put forth as educational theory by Caine and Caine (1994), Hart (1992), Jensen (n.d., 1995, 1996, 1998), Kotulak (1996), Smilkstein (1998), and Sylwester (1995, 2000), among others. It has been used to develop learning activities that are compatible with how people naturally process information.

The theory addresses both the physiological and cognitive functioning of the brain and mind. For example, Smilkstein (1993, 1995, 1998) states that when teaching a student a fact, the instructor must determine what the student already knows about that fact, and begin instruction at that point, which may mean going back to establish some prerequisite knowledge. In so stating, she is referring to (1) the physiological presence of neural dendrites that hold information and make connections with other dendrites as learning occurs and (2) the cognitive idea of schema (prior knowledge). Brain-based instruction addresses the areas of motivation, attitudes, emotion and learning, experiential learning, learning style, attention, and memory.

While all learning involves the brain and cognitive functions, the term "brain-based learning" (also called "brain compatible learning") refers to structuring educational activities according to what current research says about the brain's natural way of processing information (Caine & Caine, 1994; Diamond & Hopson, 1999; Hart, 1992). Some educators predict that brain-based learning will lead to a paradigm shift capable of

revolutionizing education as we know it (Caine & Caine, 1994; Hart, 1992; King, 1997; Smilkstein, 1998; Sylwester, 2000). Brain-based considerations in learning include the recognition that emotion inhibits or strengthens the processing information (Caine & Caine, 1994; Hart, 1992; Howard, 1994; Sapolsky, 1996), that learning involves physical changes in the brain (King, 1997; Smilkstein, 1998; Sylwester, 1995, 2000), that knowledge about the systems of attention and memory can facilitate learning (Caine & Caine, 1994, 1997; Jensen, 1995, 1998; Sylwester, 1995, 2000), that education and learning involve a total person, not an isolated intellectual element (Caine & Caine, 1994, 1997; Hart, 1992; Sylwester, 2000), and that the brain develops in response to a person's experiences (Diamond & Hopson, 1999).

As applied to this study, this theory holds that curriculum developed with activities based on natural brain functioning can help students become interested, active, and successful learners. English 060 students perform at about junior high skill level of writing, and they exhibit learning concerns in many areas addressed in the brain-based model: attention, motivation, memory, effort, emotional concerns, and conceptual and abstract thinking (Roueche & Roueche, 1993, 1999a). If brain-based instruction works as its proponents say it will, students and instructors will find the instruction less stressful and more effective.

Definitions

Behaviorist Orientation to Learning – learning is viewed as a stimulus-response activity as demonstrated by Skinner and Pavlov; in the behaviorist model, teachers deliver "knowledge" to students, who are the passive recipients of that knowledge (Merriam & Caffarella, 1991).

Brain-Based Instruction (Also called "brain-compatible learning") – Activity designed to be compatible with the brain's natural way of processing information as stated by Caine and Caine (1994), Kotulak (1996), Smilkstein (1993, 1995, 1998, 1999), and Sylwester (1995). This includes developing students' interest and motivation by appealing to their emotions, relating instruction to students' own experiences, involving them in stories, and setting the stage for success by beginning instruction at students' level of proficiency, incorporating humor and the unexpected, incorporating group work, and relating to students' own experiences. Instruction would appeal to multiple senses, involve interesting themes in readings and writings, and give students problems (puzzles) to work through. Next would come providing opportunities for students to practice, make mistakes, and correct their own work. Throughout the instruction, students would be encouraged to devote time and effort to their work, praised appropriately for what they do well and encouraged to think through their mistakes with a positive attitude. Students will be encouraged to think of writing as a process as opposed to a product.

Cognitivist learning theory – the view that learning is a process of integrating new information with a person's existing "schema" of the world to create a new sense of the world (Merriam & Caffarella, 1991).

Constructivist learning theory – the view that individuals construct reality through their experiences and reflection on those experiences (Cooper, 1993; Mellor, n.d).

Developmental Education (also called "remedial" education) – According to the National Center for Developmental Education (NADE, 2001), developmental education

promotes the cognitive and affective growth of all postsecondary learners. It includes instruction and counseling support offered to students whose skills require them to do extra work in order to succeed at college level work. The word "developmental" refers to the concept of lifelong learning and the idea that students and all adults continue to develop themselves not only by learning the content, but also as learners.

Developmental Theory of Learning – holds that individuals progress through specified stages of growth and development that affect their readiness for learning (Davis, 1991a).

Experiential Learning – the view that learning occurs through reconstruction of experience and that emphasis should be placed on the process (as opposed to product) of educational experiences (Dewey, 1897, 1938).

Humanist Learning Orientation – the view of learning as developing the human potential for growth (Merriam & Caffarella, 1991).

Learning Styles – the theory that individuals perceive and process information in very different ways according to their cognitive, affective, and physiological traits (Bonham, 1995).

Metacognitive process -The act of being able to identify and analyze one's own thinking processes and patterns, especially in an effort to facilitate learning.

Multiple Intelligences – The theory that individuals have strengths in one or more of nine (originally seven, but now expanded to include nine) learning styles that are associated with specific regions of the brain – the learning styles include verbal-linguistic, logical-mathematical, visual-spatial, body-kinesthetic, musical-

rhythmic, interpersonal, intrapersonal, naturalist, and existentialist. (Gardner, 1993; "Nine Current Learning Theories," 2000).

Open-door policy– the policy of admitting all applicants age sixteen and older to community colleges and providing support for students whose programs require prerequisite levels of reading, math, and study skills (Cohen & Brauer, 1996; Roueche & Roueche, 1999a, 1999b).

Schema theory – the view that new learning becomes meaningful only to the extent that it connects to a person's prior knowledge of the world (Davis, 1991b; Merriam & Caffarella, 1991).

Social Orientation of Learning – people learn from observing, imitating, and taking cues from others (Merriam & Caffarella, 1991).

Student attitude toward writing – Students' confidence in their ability to write; their belief that they can develop and strengthen their skill in writing through practice and instruction; their willingness to spend time and effort on planning, producing, and revising writing assignments; and their overall enjoyment of the process of writing and production of text representing their thoughts.

Delimitations

The case study involves three English 060 classes on the same campus (Centennial Campus) of Pikes Peak Community College, including one taught by the researcher. Each of the instructors chose an area or areas of instruction in the English 060 class for which brain-compatible lessons or units were developed.

Limitations

Methods using brain-based theory can be found in other educational theories as well. For example, the brain's propensity for socialization makes collaborative learning a viable brain-based instructional activity. Collaborative learning is also found in the theories of Kolb (1984), Gardner (1993), and others (Bruffee, 1993; Johnson, Johnson, & Smith, 1998; McKeachie, 1994; Slavin, 1995). Therefore, instructors knowledgeable in collaborative methods may be using a brain-based principle in their instruction without direct knowledge of brain-based learning principles. Also, for this study faculty might present only one brain-based lesson, which could not be expected to result in a significant gain in students' scores on the quantitative instruments.

The use of single impromptu writing samples as measures of student performance has some limitations. The students' writing sample evaluation instrument is not normed, but it does have inter-rater reliability in that readers have been trained to use the instrument. Timed impromptu writing samples have been criticized as not representative of students' ability and as not reliable (Gao & Colton, 1997; Hayes, Hatch, & Silk, 2000; Shaughnessey, 1977; Wiggins, 1998; "Writing Assessment," 1995). English 060 traditionally experiences a high drop out rate, so it can be expected that up to one fourth of the students who begin the study will not be there to conclude the study.

Researcher's Perspective

I was both participant and researcher in this study. As participant, I incorporated elements of brain-based instruction into my English 060 class, responded to the same interview questions as the other faculty members, and wrote a journal throughout the study. My information was coded in the same manner as that of the other participating

faculty members. As researcher, I recruited and interviewed the two participating faculty members. I also presented them with a written overview of the principles of brain-based instruction through conversations and text. In discussions both in the interviews and in the course of working together, I pointed out when their own instruction demonstrated elements of brain-based theory. As researcher, I was the primary agent for coding the text of interviews and journals.

As the researcher, I have biases regarding this study. First, I think that brain-based instruction has much to offer in teaching English 060; I think that even though other models have similarities, that the brain-based teaching and learning model is more comprehensive. Second, my undergraduate and graduate school majors are in psychology and education, and it is through my two minors in English that I have come to teach developmental students to write. With that background I have noticed that my perspective of what is going on with English 060 students at times differs from those with English majors. I will be interested in the response of other English instructors to the brain-based method as a way to clarify the differences in perspective that I have noticed, if indeed they are present as I think they are.

Significance of the Study

The incorporation of brain-based principles into instruction has been the subject of study for over twenty years, primarily for the elementary and high school level. A recent search of dissertations using the terms "teaching and learning" and "brain" resulted in 100 dissertations from 1980 to 2003; when the term "college student" was added, only five dissertations appeared (from 1981 to 1998). A search using "teaching and learning" with "brain-based" produced eight dissertations from 1994 to 2002, and the addition of

the term "college student" reduced that number to zero. A search using the terms "teaching and learning" with "brain-compatible" produced two dissertations (1990 and 1997), and the addition of the term "college student" again resulted in no dissertations.

This mixed method case study provides a beginning point for discussion of application of brain-based learning strategies for community college developmental writing students. It provided three developmental English instructors the opportunity to develop brain-based lessons and reflect on their effectiveness. It provided the instructors and several of their students the opportunity to comment on what they identified as effective instruction, which was then compared to elements of the brain-based model.

The study furthers the body of knowledge on application of brain-compatible instruction for developmental English in the community college. Besides creating models of delivery of instruction according to brain-compatible theory, the study identifies the perspectives of students and instructors regarding the effects of those methods.

CHAPTER 2: LITERATURE REVIEW

An understanding of the challenges and opportunities of developmental English students and instructors and the possible benefits of incorporating brain-based strategies requires a discussion of developmental education, adult learning theory, composition theory, and brain-based theory.

This literature review began with a search in the Colorado State University's electronic library catalog (SAGE) and data bases, including the dissertation abstracts, ERIC and Cambridge abstracts, and education database (OCLC First Search and EBSCO Host). To research brain-based theory, the following search terms were used: "brain-based or brain-compatible" with "teaching and learning" and "college" or "adult learner." Another search was conducted using "college or community college" with "developmental education." or "developmental student." Later searches added the terms "composition," "cognition" with "learning," "developmental education," and "college composition" or "composition." The Amazon.com web site was used to search for books on brain-based or brain-compatible learning theory as well as to search for the current works of specific authors. References cited in articles and books were used as sources for additional inquiry. The National Association of Developmental Education web site was frequently accessed for information on developmental education, developmental students, and learning theory.

Later, it became apparent that information on adult learning theory would develop a base for comparison with brain-based learning theory. Merriam and Caffarella's (1991) *Learning in Adulthood* offered a classification of adult learning theories and a list of representative theorists. That list provided the framework for a search in the Colorado State University's electronic education database and on the internet using specific names of theories and theorists. Internet sources were evaluated for credibility through direct association with a theorist or through association with a credible education entity, such as a college or university or a reputable education organization such as the League for Innovation in Education. Articles appearing in popular magazines and on the internet were used when information could be traced to a credible source.

This chapter will trace the need for Developmental Studies in postsecondary education in the United States from its beginnings to today, describe the characteristics of developmental students in community colleges, give a brief overview of adult learning theory and theorists, relate composition theory to learning theory, and summarize research in how the brain learns from the fields of neuroscience and the cognitive sciences.

The discussion of the need for developmental studies and the characteristics of underprepared community college students will establish the need for methods to help students since so many do not succeed in their educational pursuits. The discussion of adult learning theory and composition theory will identify current approaches to meet the needs of underprepared students, many of which are compatible with brain-based strategies. Finally, the discussion of brain-based learning will provide a background in

the development of brain-based learning theory and present elements of the theory which can be compared with composition and adult learning theory and practices.

The Need for Developmental Education

The United States faces an educational crisis. In *No One to Waste,* his report on The National Study of Community College Remedial Education, Robert McCabe (2000) writes,

> Eighty percent of new jobs will require some postsecondary education; unfortunately, only 42 percent of students leave high school with the necessary skills to begin college-level work. A third of those who enter college are underprepared . . . . Despite current aggressive school reform, substantial numbers of young Americans will reach adulthood underprepared for employment in the information-rich 21st century. (pp. vii-viii)

Statistics such as those reported by McCabe come as no surprise to most people. That businesses find it difficult to fill positions with people who have adequate reading, writing, and math skills is a frequent topic of the media. The situation can be expected to worsen as rapid changes in technology require hiring employees who are not only literate, but who can learn new ways of doing their jobs, and who can be retrained if their jobs are eliminated (McCabe, 2000; Roueche & Roueche, 1999a, 1999b). Inadequate education is also associated with poverty, crime, and welfare. Besides impacting individuals, an inadequately educated workforce for the 21st Century will result in many unfilled jobs due to lack of qualified employees (McCabe, 2000).

Many view education as the key to help people break the cycle of poverty and become not only more employable, but also better citizens. With its open door, the community college offers people of all ages and backgrounds the opportunity to obtain the academic, technical, and personal skills they want and need.

While more and more people take advantage of opportunities in higher education, increasing numbers of students enter postsecondary education with skills that are considered inadequate for college level work (Hashway, 1998; Jensen, 1996; Kotulak, 1996; McCabe, 2000; Roueche & Roueche, 1999b). The open door of community colleges guarantees admission to anyone over the age of sixteen who can demonstrate the ability to benefit. Those taking advantage of increased access to higher education include recent high school graduates who are academically underprepared for college, adults who have been out of school many years, high school drop outs, nonnative speakers of English, and GED recipients (Boylan, 1999; Roueche & Roueche, 1999a). And the number of underprepared students is expected to increase (Maxwell, 1997; McCabe, 2000; Roueche & Roueche, 1999a).

The concept of developmental education has existed as long as under-prepared students have been admitted to college in the United Sates, which began when Harvard College opened its doors in 1636 as a school to train ministers. At that time, textbooks were written in Latin and Greek with courses taught in Latin; students who were not literate in Latin and Greek obtained tutoring to enable them to succeed in their studies (Boylan, 1995; Hashway, 2002; Maxwell, 1997). Even after the American Revolution when colleges and universities conducted classes in English, faculty were concerned about students' writing skills, and in 1871 Harvard initiated an entrance exam which included a section in composition; however, when 50% of the entering freshmen failed the exam and were conditionally admitted, Harvard initiated the first composition class (Boylan, 1999).

The Morrill Acts of 1862 and 1890, the GI Bill after World War II, and government aid for low-income and minority groups in the 1960s opened the doors to new students, many of whom did not have high school degrees (Casazza, 1999; Maxwell, 1997; McCabe & Day, 1998). Each period of increased access led to a concern for student preparedness. The College Entrance Examination Board was founded in 1890 to establish standard admission requirements, yet colleges continued to admit underprepared students to fill their classes, and in 1907 fewer than 50% of the students entering Harvard, Yale, Princeton, and Columbia met their entrance requirements (Maxwell, 1997). Many colleges and universities added preparatory programs to meet the needs of these students (Casazza, 1999; Maxwell, 1997).

Today, underpreparedness has been attributed to poor high school preparation as evidenced by declining SAT scores and recruitment of higher numbers of high school students (50% of graduates in 1970 compared to 25% in 1960) (Maxwell, 1997). Maxwell cites permissiveness and lowered standards and expectations in high schools along with less emphasis on college prep courses as contributing factors. Some college students had not planned to attend college, so in high school took the easiest program to graduate, and later when they did decide to go to college, needed to fill in the gaps that a college prep curriculum in high school would have provided (Maxwell, 1997; Roueche & Roueche, 1993). Maxwell (1997) and Cohen and Brawer (1996) describe the resulting drop out rate and failure rate in the 1970s as unconscionable, and in the late 1970s and 1980s many colleges established mandatory assessment and placement into developmental courses in an attempt to provide underprepared students the skills to succeed in an effort to reduce the drop out and failure rates.

The 1983 National Commission on Excellence in Education's "A Nation at Risk" called for reforms in education to allow every American the opportunity to achieve a better life through education. Because of increased access to postsecondary education for underprepared students, more students were candidates for support programs to help with academics and adjustment to college than ever before (McCabe & Day, 1998; Maxwell, 1997). Maxwell says that the "need for more preparation is increasing, and there is no end in sight" (p. 2). Today, developmental education has expanded to include a variety of support services including tutoring, advising, counseling, peer tutoring, among other possibilities (Boylan & Saxon, 2002).

Many describe the current need for development as greater and more critical than in the past (Maxwell, 1997; McCabe, 2000; Roueche & Roueche, 1999a, 1999b). Jensen (1996) reports that "children today are really less prepared for school" as evidenced by "emotional development, motor sensory development, and school readiness" (p. 19). Hashway (1998) notes that "college entrance examinations and other types of achievement assessment scores have been declining since about 1964" (p. 12). Maxwell (1997) identifies permissiveness and lowered standards and expectations in high schools along with less emphasis on college prep courses as contributing factors to underpreparedness of college students.

Roueche and Roueche (1999a) cite the nation's high functional illiteracy rate (25% of the U.S. workforce), decline of unskilled jobs and increase in jobs requiring use of technology, increase in minority populations (which have been linked to higher levels of academic underpreparedness), and increase in non-English-speaking immigrants (both

legal and illegal) as factors contributing to a greater need for support in order to maximize prospects of success in higher education.

McCabe (2000) reports that presently only 67 percent of young Americans graduate from high school, and only 42 percent of those graduate ready for college level work (p. 25). In "Confronting" (1997), the National Center for Educational Statistics reports that about 58 percent of 1992 high school graduates had one or more risk factors (16 percent having two risk factors and 9 percent having three or more). And more recently, *Time Magazine* reported that in fall of 2002, 600,000 of U. S. college freshman (29% of the total) enrolled in at least one remedial course (Cloud, 2002).

The Roueches (1999a) report that

> Social, demographic, and educational factors will swell the population of underprepared students entering higher education for at least the next two decades. Unconscionable numbers of high school graduates underprepared for college work are but one segment of the underprepared population; they are joined by high school dropouts, GED recipients, returning adults, new immigrants, welfare recipients, and others. These students will represent ever-larger proportions of every new freshman community college class. (p. 7)

Roueche and Roueche (1999b) estimate that 50 percent of students complete their remedial work successfully. Studies show that college students with greater academic strengths persist and graduate at a higher rate than those with weaker academic skills (Kosteleba, 1997; Gandy, 1998; Purcell, 1997; Van Dyke, 1989), and support through developmental studies programs has proven to increase graduation and retention rates of students identified as entering college with weak academic skills (Boylan, 1985,1999; Boylan & Saxon, 2002; Casazza, 1998; Cohen & Brawer, 1996; Higbee & Dwinell, 1997; Hilliard, 1991; Hopper et al., 1997, Long & Amy, 1993). Van Etten's (1997) study of 182 students in a Colorado post-secondary institution in the fall of 1988 found that

students taking developmental classes had higher rates of persistence than those taking non-developmental courses. Because of the demands of college, developmental students report that writing classes can contribute greatly to their success (Higbee & Dwinell, 1997; Hopper et al., 1997).

Characteristics of Developmental Students in the Community College

Some very capable students enroll in developmental classes either for a review or to boost their self-confidence. McCabe (2000) notes that many students come to the community college ten or more years after high school, and having gained some life experience, just need a refresher before moving on to their college courses. Others are able to succeed in college level courses, but due to lack of confidence prefer to cover the basics to give them a good foundation before they enroll in college level work.

However, for many, developmental education is not a repetition of high school course work (McCabe, 2000). A significant number of developmental students exhibit one or more of the following characteristics of at-risk students: (1) lowest socioeconomic quartile; (2) single-parent family; (3) average grades of C's or lower from 6th to 8th grade; (4) repetition of a grade between 1st and 8th grade; (5) having dropped out of school (Data, Definitions, 1998). McCabe (2000) notes that low-income students "often begin school well behind, have inadequate home support, and are still behind when they enter community college" (p. 39). The educational experience of students who earn C's or lower, repeat grades, and drop out of school could not considered adequate preparation for college level work.

McCabe (2000) identifies two academic levels of developmental students: the deficient and the seriously deficient. McCabe continues that while the success rates and

persistence of seriously deficient students is much lower than that for deficient students, deficient students have a 43 percent success rate with more than half earning more than 20 college credits, while only 20 % of seriously deficient college students succeed with only 5% earning 20 college credits or more. McCabe (2000) notes that the needs of the seriously deficient student need to be met, and they cannot be met through traditional methods.

Students taking developmental classes are a diverse group of learners. Casazza (1999) notes that in the 1990s we have come to expect untraditional and diverse students in terms of age, ethnicity, and learning style. Colleges are enrolling increasing numbers of students who are new to the country and limited in their command of the English language and/or have a history of learning problems, whether a diagnosed learning disability or not (Maxwell, 1997; Roueche & Roueche, 1999a; Roueche, Roueche, & Ely, 2001).

Maxwell (1997) and McCabe (2000) also point out that differences in college and high school expectations regarding goal setting, time management, critical thinking, and self-motivation along with lowered standards and inflated grades in high school contribute to college students' underpreparedness. Additionally, many developmental students do not have a family member who graduated from college to help them negotiate the unfamiliar territory of academia (Roueche & Roueche, 1999a).

Many at-risk students bring an array of complicating factors to school with them: unrealistic work schedules; single parenthood; rocky marriages; histories of drug and alcohol abuse; and inexperience in theoretical and conceptual thinking (Maxwell, 1997; Roueche & Roueche, 1997). In *High Stakes, High Performance*, John and Suanne

Roueche (1999a) quote Byron McClenney, then President of the Community College of Denver, as saying summing up the complexity of meeting the needs of today's at-risk students:

> How do you provide effective remedial education to a single mother with three children, a 40-hour per week job, and no transportation, who reads at the 6th grade level (perhaps with limited English proficiency), who has had a lousy experience with school and suffers from incredibly low self-esteem, and who wants desperately to create a better life for herself and her family? And how do you help this person advance about eight grade levels in a few months (with no more second chances), use technology only when technology works best, provide human support when only "high touch" will do, and ultimately provide documented, quantified (but reader-friendly) evidence of success that only the devil himself could deny? How, exactly? (McClenney, 1998, 2-3 qtd in Roueche & Roueche, p. 22).

Developmental writing students may bring with them a history of frustration with writing; low motivation; lack of awareness of expectations of attendance, homework, and classroom behavior; focus on product over process; poor time management; and inexperience in abstract thinking, any one of which could sabotage academic efforts (Roueche, Roueche, & Ely, 2001). A developmental writing student like Mica attempting to achieve sentence fluidity battles a lifetime of speaking and writing patterns that she is expected to identify and remove from her formal writing in a mere fifteen-week semester (Harley & Cannon, 1996).

With renewed support of the open door and emphasis on recruiting nontraditional students, community colleges find themselves challenged with students whose needs transcend the traditional educational delivery system (Boylan, Bonham & Bliss, 1994; Casazza, 1999; Cross, 1996; McCabe, 2000; McCabe & Day, 1998;.Roueche & Roueche, 1999a). Developmental education faculty meet their students' needs with education and experience in areas that include psychology, student development, reading, and adult

education (Casazza, 1998). Most have either formally or informally become acquainted with adult learning theory.

Adult Learning Theory

Education in the twenty-first century has experienced tension between learner and learning-centered paradigms (O'Banion, 1998; Caine & Caine, 1997; Meier, 2000; Reese, 2001). The century began with the rhetoric of educational opportunity for a democratic society in Dewey's progressive movement, but the actual practice of education through the 1950s utilized standardized methods, teachers, schools, and assessment (Meier, 2000). Mid century brought a move towards recognizing the needs of the individual learner. However, Meier notes that after "40 years of reform" and a promise "to close the [educational] gap between the masses and the elite," the reformers only had "tools of uniform curriculum, scripted teaching, curriculum- aligned testing, and monitoring of teacher and student outcomes" (Meier, 2000, p. 215).

Today, the two perspectives can be seen in the learning college, as espoused by the League for Innovation in Education (O'Banion, 1998), and the learner-centered college, as practiced by Maricopa Community College. A learning centered college follows the behaviorist tradition with emphasis on student performance in regard to standardized goals while a learner-centered college focuses on presenting information according to strategies of learning that can best accommodate individual students. A developmental educator working with a student like Mica would balance both the behaviorist outcome-centered approach to enable students to reach the skill level necessary to move to the next level as well as using strategies designed to meet the needs of untraditional learners.

The following discussion of five orientations of adult education has been adapted from Merriam and Caffarella (1991) and illustrates a continuum from behaviorist learning theory to social learning theory. Because an indepth and comprehensive examination of current adult educational theory is beyond the scope of this chapter and research study, examples of current thought were selected as a general representation of adult educational theory today. The orientations include (1) the behaviorist orientation, (2) the cognitive orientation, (3) the constructivist orientation (including experiential learning, developmental theory, learning styles, and multiple intelligences), (4) the humanist orientation, and (5) the social orientation.

It should be noted that no single classification of current education theories exists (Merriam & Caffarella, 1991), so that concepts in each orientation build on and overlap with concepts in other orientations; also, the same theorist may be classified differently according to the writer. For example, Piaget has been classified as a developmentalist, cognitivist, and constructivist ("Cognitive Constructivism," n.d.).

Behaviorist Orientation

Dominant in American education from the 1920s to the 1950s, behaviorism identifies learning as occurring when a learner responds to external stimuli and as being strengthened through practice ("Nine Current Learning Theories," 2000). Behaviorist theory includes the following assumptions: (1) the focus is on observable behavior as opposed to internal mental processes, (2) learning results in a change of behavior, and (3) learning comes from an outside source, the environment, as opposed from within the learner (Merrian & Caffarella, 1991). Additional elements to the stimulus-response model include Pavlov's concept of reinforcement, conditioned stimulus, and extinction;

Tolman's concept of intervening variables such as purpose; Hull's concept of the importance of motivation, habit, strength, and drive; and Skinner's concept of operant conditioning which led to the theory of behavior modification (reported in Merriam & Cafarella, 1991).

The University of California Teacher Education Program's web page describes learned helplessness as a student's self-perception that success does not result from his/her own effort. The site promotes the behaviorist model of positive reinforcement as an effective means of helping students overcome feelings of learned helplessness. The strategy is for teachers to acknowledge what students do correctly while briefly explaining the correction of an error in their work and walking away to reinforce the idea that students should work on their own as opposed to only working while the teacher is "standing over them" ("Eliminating Learned Helplessness," 2001, p. 2).

Behaviorists deliver instruction through lecture, guided practice, mastery learning, and computer-aided instruction ("Nine Current Learning Theories," 2000). The behaviorist model is teacher-centered with the teacher's role that of designing instruction that elicits the desired learning tasks. Underlying behaviorist theory is the concept that knowledge lies outside the individual and is concrete and objective.

Merriam and Caffarella (1991) write that behaviorist principles "underlie much educational practice, including adult learning" (p. 128). As in the early 1980s with the publication of "A Nation at Risk," Americans are facing a "documented failure of American students to learn" and the behaviorist principles of accountability and standards based education (related to funding) is becoming more popular (Stoops, 1996, p. 3). The behaviorist orientation has received criticism because it can be "overly prescriptive, can

promote mediocrity, and can encourage conformity and control" (Merriam & Brockett, 1997, p. 152) and because it does not promote higher order and critical thinking skills (Merriam & Brockett, 1997; Stoops, 1996). Behaviorist principles can be seen today in behavioral objectives, competency-based education, instructor accountability, and skill development and training (Merriam & Caffarella, 1991).

Cognitive Orientation

According to cognitivists, "learning involves the reorganization of experiences in order to make sense of stimuli from the environment. Sometimes this sense comes through flashes of insight" (Merriam &Caffarella, 1991, p. 129). Learning is a process of integrating new information with existing information, or schema, to create a new sense of the world, or schema. Like behaviorists, cognitivists see knowledge as existing outside the individual, and to that they add to concept of active mental processing occurring within the individual.

Jerome Bruner is considered instrumental in the cognitive movement in education in the United States with the publication of *A Study in Thinking,* which he co-authored with Goodnow and Austin in 1956 ("Cognitive Psychology," 1999; Smith, 2002). One of Bruner's tenets was the concept of the spiral curriculum in which material is presented more than once, each time adding complexity and sophistication to the information, thus enabling students to gain familiarity with content and then building on their understanding of it (reported in Smith, 2002). Bruner also believed that students learn by both intuitive and analytical thinking, that students must be motivated to be active in the learning process, and that learning is facilitated by teaching not only facts and techniques, but also the context, or bigger picture (reported in Smith, 2002). More recently Bruner

has shifted his focus to the importance of culture and society as significantly impacting how people construct knowledge as presented in his 1996 book *The Culture of Education* (reported in Smith, 2002).

An important concept in cognitive theory is that each person has constructed his or her own unique construct of the world, or schema, based on his or her experience ("Schema Theory," n.d.); more recently Piaget is credited with using the term in 1926, and in the 1960s Ausubel paved the way for schema theory by claiming that meaningful knowledge (as opposed to rote knowledge) cannot be processed unless it connects to prior knowledge (reported in Merriam & Caffarella, 1991). Educational psychologist R.C. Anderson is credited with developing the theory to explain the process by which an individual organizes a "network of abstract mental structures which represent one's understanding of the world" (reported in Davis, 1991b, p. 1).

According to schema theory, because new knowledge builds on prior knowledge, it is important to help students strengthen general and basic knowledge so that they have a framework in which to attach new knowledge (Davis, 1991b). Information forming a person's schema is "organized meaningfully, can be added to, and, as an individual gains experiences, develop[s] to include more variables and more specificity" (Davis, 1991b, p. 1). When presented with ambiguous information, a person can fill in the missing information because of his prior knowledge about similar situations. However, there is always the risk of misinterpretation by relating information to inappropriate schema. For this reason, educators are encouraged to provide unifying themes and show connections of the content (Perry, 2001). Also, new information which conflicts with a person's

existing schema creates conflict, and people sometimes do not assimilate new information because it conflicts with strong values and beliefs (Davis, 1991b).

Israeli educational psychologist Reuven Feuerstein has designed activities to build conceptual thinking in at-risk learners. Feuerstein's idea of cognitive modifiability is simply that of building and strengthening thinking skills that enable an individual to process information efficiently and in line with cultural expectations. His worksheets are designed to stimulate conceptual thinking with basic tasks and then progress to more complex thinking. In the Feuerstein model, educators and the worksheets mediate student learning to help them build conceptual thinking and see connections. Feuerstein has identified twenty-two cognitive functions, or ways of approaching a task or seeing the world, which help people function in an academic world. He sees that deficiencies in these cognitive functions interfere with students' learning (Feuerstein & Hoffman, 1980).

For the cognitivists, the role of teacher moves from the behaviorist model of deliverer of information to one of designer of instruction with an understanding of mental processes that results in the learner becoming an active processor of information (Merriam & Caffarella, 1991). According to schema theory, knowledge has a hierarchy in which prerequisite facts need to be available to an individual before he or she can more on to higher-level concepts (Davis, 1991b). Therefore cognitivists teach or strengthen general knowledge and basic skills to prepare a person for new complex information. The cognitivist perspective also promotes helping students become aware of their own learning processes through metacognition.

Constructivist Orientation

In contrast to the behaviorist and cognitivist views that reality is stable and objective, constructivists believe that individuals create knowledge of the world through their interaction with their environment and relating experiences with their past experiences and talents ("Nine Current Learning Theories," 2000). In the behaviorist model, students are considered passive recipients of information delivered by instructors; however, in the constructivist model they are considered active participants in their learning with instructors providing feedback and facilitating the learning process (Mellor, n.d.). In contrast to the cognitivist view that knowledge is given and absolute, constructivists view knowledge as relativistic and unique for each individual ("Constructivism," n.d.).

The roots of constructivism can be found in the questioning process of Socrates to help students refine their thinking, in eighteenth century Italy's philosopher Giambattista Vico "who held that humans can only clearly understand what they have themselves constructed," and as developing from the work of Jean Piaget and John Dewey (Clark, 1999, p. 1). Four guiding principles of constructivism are that (1) learners actively construct meaning from their world; (2) the construction of meaning requires understanding wholes as well as parts, which requires awareness of concepts as opposed to isolated facts; (3) educators must be aware of students' assumptions about and perception of the world (schema and mental models); and (4) standardized tests and grades should be eliminated and assessment should become part of the learning process with students given a role in evaluating their own learning.(On Purpose Associates, "Constructivism," 2001). Included in this discussion of the Constructivist Orientation are

experiential learning, cognitive theory, developmental theory, learning styles, and multiple intelligences.

Experiential learning. The concept of experiential learning is that learning is facilitated by how learners "attach meanings to or make sense of their experiences" (Merriam & Brockett, 1997, p. 153). In the United States, the concept of experiential learning began with the call for educational reform by John Dewey in 1897, and it can be seen today in the work of Kolb and in learning that takes place outside the classroom such as internships, credit for prior learning, service learning, and volunteerism (Merriam & Brockett, 1997).

In 1897, John Dewey argued that education should be meaningful, applicable, and related to real-life experience. In "My Pedagogic Creed," he wrote that progress in learning

> is not in the succession of studies but in the development of new attitudes towards, and new interests in, experience. I believe finally, that education must be conceived as a continuing reconstruction of experience; that the process and the goal of education are one and the same thing. I believe that to set up any end outside of education, as furnishing its goal and standard, is to deprive the educational process of much of its meaning and tends to make us relay upon false and external stimuli. . . . (Dewey, 1897, p. 7 of 11).

Kolb's experiential model consists of designing instruction so that students experience material to be learned in four stages: (1) concrete experience (CE) in which learners experience the content physically and emotionally (may have to be a vicarious experience), (2) reflective observation (RO) in which students think about and interpret the experience from multiple perspectives and make connections to other experiences, (3) abstract conceptualization (AC) during which they compile information for other sources and develop hypotheses and principles about the experience, and (4) active

experimentation (AE) during which they apply information they have obtained to problem-solving situations (reported in Merriam & Brockett, 1997).

In experiential learning, the teacher serves as facilitator, helping the student interpret his experiences. Lee and Caffarella (1994) identify three important aspects of experiential learning activities for adult learners. First, the learning activities connect new information with existing "knowledge, beliefs, affective characteristics, and experiences" (Lee & Caffarella, 1994, p. 43). Therefore, new information is always integrated with each learner's unique base of knowledge and experience. Second, in experiential learning, learners are self-directed in their own learning by taking part in their own reflection and evaluation of learning, and assuming control of their learning experiences (Lee & Cafarella, 1994). Third is the inclusion of application of the instructional material in simulated or real-life situations (Lee & Cafarella, 1994).

Current applications of experiential learning include field-based experiences such as internships and practicum assignments and service learning; classroom experiences of role play, case studies, simulations and values clarification exercises; and outdoor programs designed to build teamwork and risk-taking through physically challenging experiences (Lewis & Williams, 1994). Lewis and Williams (1994) note that learners need to reflect on their experiences in order to obtain the most benefit. Also, they emphasize the importance of learners assuming responsibility for their own learning and for educational programs to establish their effectiveness with clear objectives, solid methodology, and credible evaluation.

Developmental theory. Developmentalists identify stages of mental, emotional, and/or physical growth through which an individual's readiness for learning changes

(Davis, 1991a; Pascarella & Terenzini, 1991). Theories of adult learning identify stages of development along personal development, personality development, social development, moral development, and the need for growth (Courtenay, 1994). Pascarella & Terenzini (1991) identify similarities among developmental theories, including the development of internal vs. external controls, balancing the sense of autonomy and identity with others, progressing toward more responsible and principled behavior. Theories also acknowledge the importance of social interaction, cognitive readiness, presence of a stimulus that will cause a person to re-evaluate concepts in a more complex manner to move into the next stage, and the importance of being able to detach from self and empathize with others in order to move to higher developmental levels (Pascarella & Terenzini (1991). According to Courtenay (1994), the stages are presented as going from "simple to complex, from rigidity to flexibility, and from narrow to comprehensive perspectives" (p. 147) and share the common goals of "autonomy, separateness, and independence" (p. 148). The stages are present as hierarchal with people not always reaching the "top" stage, at which a person would be judged to have reached the ideal state (Courtenay, 1994). Courtenay (1994) questions the value of holding adult learners with their unique backgrounds and purposes for education to any one standard of adult development.

Jean Piaget (1896-1980) identified four stages of cognitive growth through which children develop their mental capacities. The stages are (1) sensorimotor (birth to two years old) during which children explore their world through physical interaction as a beginning to gaining understanding; (2) preoperational (ages two through seven) during which children begin to use symbols based on concrete experience; (3) concrete

operations (ages seven to eleven) during which children begin to conceptualize; and (4) formal operations (eleven years and beyond) during which children develop the capacity to think in abstract and conceptual ways about their world (reported in Pascarella & Terenzini, 1991). Pascarella and Terenzini (1991) cite a number of researchers presenting evidence that up to 55 percent of all college students do not perform at Piaget's level of formal operations.

According to Piaget, individuals faced with a learning opportunity first experience disequilibrium when the new information does not fit with their mental experience (schema). First they assimilate the new information into their existing schema, then they revise their schema in light of the new information or experience (accommodation), and finally they will achieve equilibrium with their new schema. According to Piaget, students learn well from making and correcting errors. Also, learning in realistic settings in collaboration with others is ideal. Finally, students should be given time and freedom to construct meaning of their educational experiences ("Cognitive Constructivism," n. d.).

Learning styles. This approach acknowledges that individuals perceive and process information in very different ways according to their cognitive, affective, and physiological traits. Learning styles are manifested in students' instructional preferences, information processing styles, and cognitive personality styles (Bonham, 1995). Learning styles differences have been noted with nontraditional learners such as minorities, those with learning disabilities, and adults (Anderson, 1988).

One type of learning style is that of right- and left-brain thinking (Wonder & Donovan, 1984). The idea was that people prefer learning through either the left (analytical) brain (which is logical, sequential, rational, analytical, and objective) or the

right (artistic) brain (which is random, intuitive, holistic, synthesizing, and subjective). Traditional American education worked well for people who primarily process information in the right brain style, but not for people who processed information using the left brain style. Instruction appealing to right brain styles was developed by incorporating metaphors, analogies, role-playing, visuals, and movement. Therefore, instruction using the whole brain was encouraged in order to reach mores students and be effective as well as to help students develop their less dominant "brain."

Dunn and Dunn (1978) developed a learning style inventory profiling students on twenty-three elements of instruction in five domains: (1) environmental stimulus (sound, light, temperature, design); (2) emotional stimulus (motivation, persistence, responsibility, structure); (3) sociological domain (self, pair, peers, team, adult, varied); (4) physical domain (perceptual, intake, time, mobility); and (5) psychological domain (global vs. analytic, hemisphericity, impulsive vs. reflective). Studies showed matching students with their preferences resulted in positive academic achievement and attitudes (Dunn, Griggs, & Gorman, 1995).

Schroeder (1993) writes that a mismatch between learning styles of college instructors and their students as measured by the Myers-Briggs Type Indicator (MTBI) accounts for some faculty discouragement when students don't respond well to instruction. Schroeder (1993) writes that the first two Myers-Briggs categories can account for differences in learning style that interfere with student-instructor communication: (1) extroversion versus introversion (whether a person operates primarily from within or from the external world) and (2) sensing versus intuition (perception of world either through direct observation or through impressions).

According to Schroeder (1993) most faculty tend to be abstract/reflective while many students tend to be concrete/active learners. Schroeder (1993) suggests "bridging the gap" by designing instruction to meet the learning styles of students as well as helping students experience alternative learning styles (pp. 5-6).

Anderson (1988) identifies differences in learning styles between Western and Non-Western (which includes minority Americans) students as barriers to scholastic achievement by minorities and calls for teachers to be open to alternative styles. Some differences between Non-Western and Western learning style include emphases on group cooperation versus individual competition, relative versus rigid time schedule, importance of extended versus nuclear family, holistic versus dualistic thinking, task versus social orientation, verbal versus analytic performance, dependent versus independent learning style (Anderson, 1988). Claxton (1990) prefers not to associate specific learning styles with specific groups, but encourages educators to recognize differences in learning styles and teach to a variety of styles as a way to reach all students more effectively and because people learn to different degrees in all the learning styles, and are able to strengthen their less dominant learning styles.

Multiple intelligences (MI). Howard Gardner defines intelligence as "an ability to solve problems or create products that are valued in at least one culture" (reported in Harvard, 1999, p.1). He has identified nine mental abilities (or intelligences) that are associated with specific areas of the brain; everyone has all of the intelligences, each in a unique combination (Harvard, 1999). Gardner says people's proficiency in any of the nine intelligences can be strengthened to some degree with practice. The intelligences are

verbal-linguistic, mathematical-logical, musical, visual-spatial, bodily-kinesthetic, interpersonal, intrapersonal, naturalist, and existential ("Thirteen," n.d.).

According to MI theory, short answer and multiple choice tests do not measure deep understanding, and students should be assessed with performance than reveals process as opposed to product, (Gardner, 1993). The role of MI teachers is to structure learning activities that allow for performance in various intelligences and connect subjects. MI is learner centered in that students manage their own learning and learn to value their individual strengths. One of the criticisms of MI is that it defeats standards-based efforts ("Thirteen," n.d.).

The constructivist orientation differs from cognitivist and behaviorist in its view that each person constructs a unique understanding of the world by integrating new experiences and concepts with existing understanding of the world ("Constructivism," 1999; Cooper, 1993). It is learner-centered in that it promotes students reaching deeper understanding through directing their own learning through process-based activities.

Humanist Orientation

Theories in the humanist orientation grew from the work of Maslow and Rogers and relate to the human potential for and propensity toward personal growth and include the affective domain as an important aspect of learning (Merriam & Caffarella, 1991). Androgogy, self-actualization, self-directed learning, and transformational learning are all within the humanist orientation.

Malcolm Knowles (1984) developed his theory of andragogy (as opposed to pedagogy) to describe the unique style of adult learning. Knowles says that adults learn best when they have a reason to learn specific material, when they learn by experience

and through problem solving, and when there is an immediate reward for learning (reported in Kearsley, 2002). Knowles describes adults as self-directed learners, so that they should be active in the design of their own instruction (Kearsley, 2002). However, Knowles and others also realize that at different times in their lives adults may need support in their movement towards self-directness (Caffarella, 1993). Grow (1991) identifies four stages of student directedness towards learning (dependent, interested, involved, and self-directed) and teacher behaviors that help students move toward self-directedness.

Mezirow (1981) emphasized the aspect of transformation in adults' educational experiences. As a result of their critical reflection on their experiences, they interpret and adjust their underlying assumptions about life and move toward personal development (Merriam, 1993). Chickering and Reisser (1993) identified seven vectors of growth that adults in transition may experience in the areas of (1) developing competence, (2) managing emotions, (3) moving through autonomy toward independence, (4) developing mature interpersonal relationships, (5) establishing identity, (6) developing purpose, and (7) developing integrity.

Because a person in transition may experience self-doubt, ambiguity, and stress, those ascribing to the humanist orientation provide challenge for growth along with support in that endeavor (Champagne & Petitpas, 1989; Cross, 1996). Cross wrote that "there is a natural tendency for people to learn and that learning will flourish if nourishing, encouraging environments are provided" (1981, p. 228). She identified several variables affecting a person's participation in education, including motivation,

perception of possible positive and negative consequences, personality factors, needs for achievement, readiness, and self-confidence (Merriam, 1993).

In the humanist orientation, instructors encourage self-growth and fulfillment through education. The final orientation expands on the personal dimension to include the role of society in one's achievement of potential.

Social Orientation

The social learning orientation focuses on the fact that people learn from people and in a social context. The social orientation includes the concepts of locus of control, collaborative learning, mentoring, situated cognition, and the work of Vgotsky in social cognition (Merriam & Caffarella, 1991). Included in this orientation is the role of education in liberating the oppressed as expressed by Freire (1986) and Belenky, Clinchy, Goldberger, and Tarule (1986).

The idea of individual locus of control comes from attribution theory relating to whether a person attributes success or failure to personal effort and skill or forces beyond his or her control such as fate and luck (Grantz, 2002). According to attribution theory, people who credit their accomplishments to their own efforts (those with an internal locus of control) work harder towards their goals, especially in the face of failure. Those with an external locus of control, however, do not perceive success as a result of their own effort, and tend to feel that working harder is futile (Grantz, 2002). Studies have shown a correlation with internal locus of control and student success and retention (Grantz, 2002). According to attribution theory, teachers can help students strengthen their internal locus of control with statements that indicate the student is in control, such as

"You're trying more, keep at it," as opposed to reinforcement statements such as "I'm pleased with your progress" ("Attribution Theory," 1996).

Collaborative learning activities have the dual benefit of giving students the experience of working together as teams as well as encouraging active learning and the opportunity to learn from and teach their peers (Landsberger, 2002). Collaborative learning strategies have been associated with retention of minority students and found to be helpful for nontraditional students ("Collaborative Learning," 2002).

Mentoring programs allow students to meet with a peer or faculty to help them negotiate the college system or just listen to their concerns and progress. Mentoring programs have been found to empower students in transition and help them build support networks and find resources (Champagne & Petitpas, 1989; Cross & Steadman, 1996).

Situated cognition holds that context and setting are not just aspects of learning, but integral to any learning situation (Brown, Collins, & Duguid, 1989; Wilson, 1993). Brown, Collins and Duguid note that the educational community assumes "a separation between knowing and doing" when in reality "activity and situations are integral to cognition and learning" (p. 32). They assert, "by ignoring the situated nature of cognition, education defeats its own goal of providing useable, robust knowledge" (p. 32). As a result, instruction in the context of a classroom may, by nature of not being in the field, omit important features of the real-life situation to the degree that the learning does not transfer to a real context. Therefore, providing educational activities that are as close to real-life situations as possible helps students gain understanding in a better way than traditional classroom instruction (Brown et. al., 1989; Wilson, 1993).

The Russian psychologist Vgotsky believed that man obtains knowledge of the world through social interaction. His zone of proximal development is the point at which an individual needs coaching to move to the next level of understanding/knowledge (reported in Nicholl, 1998). Vgotsky recognized the benefit of collaboration in learning and in scaffolding, supporting a learning in early stages and providing less and less direction in the learning ("Lev S. Vgotsky," n.d.).

Freire devoted his life to liberated oppressed people of the world through education. Freire wrote that since education is by nature political and social, the role of the teacher is to "reveal reality for students, removing whatever keeps them from seeing clearly and critically" (Freire, 1986). Belenky, Clinchy, Goldberger, and Tarule (1986) write that education can liberate women from the gender and societal constrictions of their lives. They refer to teacher as midwife who "draws a woman's knowledge out into the world" (Belenky et al., 1986, p. 220).

A summary of the orientations to adult learning theory has been adapted from Merriam and Cafarella (1991) can be found in Table 1. Merriam and Cafarella (1991) list four orientations while this table includes the constructivist orientation as differentiated from the cognitivist orientation. Although educators may tend to operate primarily within one orientation, most adopt a theoretical framework consistent with their own education and experience and with which they feel comfortable. Behaviorist techniques may be used for one set of circumstances while a social orientation would work for another. The orientations do, however, reflect differing perspectives on the purpose of education, the process of obtaining knowledge, and the nature of reality, resulting in emphasis to different degrees on process as opposed to product.

Summary of Orientations to Learning: Learning vs. Learner-Centered

The orientations to learning can be divided into two groups, those emphasizing the product of learning (learning centered) and those emphasizing the process (learner centered). Those with a learning-centered approach (behaviorist and cognitivist) focus on student mastery (O'Banion, 1998) and those with a learner-centered approach (constructivist, humanist, and social/empancipatory) focus on the student's interaction with the material to be learned (Elsner, 1996).

When Maricopa Community College examined itself to determine how it could become more learner-centered, it discovered that many of its procedures were cumbersome for students, and it decided to streamline procedures from student advising to registering to publicizing programs and classes (Elsner, 1996). Through support of the CEO, involvement of all campus constituencies, and commitment to students, Maricopa is becoming more learner-centered:

> Maricopa's efforts with its ...learner-centered system efforts constitute a search for a new learning paradigm. . . . Collaborative processes are more promising because they are: 1) more effective in achieving focused results; 2) they touch the smaller units of our organizations, colleges and universities; and 3) the hierarchical "top-down" approach has proven to be less effective, often making us frozen to act or to commit. (Elsner, 1996, p. 17)

The American Association of Higher Education ("Seven Principles," n.d.) identifies seven principles of learner-centered education. They include (1) regular contact between students and faculty; (2) collaborative rather than competitive interaction; (3) active learning, (4) faculty giving timely feedback to students, (5) students and faculty devoting time and effort to the business of learning; (6) holding high expectations; and (7) recognizing diversity in learning and student talents.

Over this century composition theory has experienced a similar transition (and tension) from emphasis on product to process and towards learner-centered approaches. Some attribute this to the need to accommodate the increasing numbers of underprepared students entering college since the 1970s (Maxwell, 1997; Villanueva, 1997).

Composition Theory

In 1874 Harvard offered the nation's first freshman composition class in response to the number of students unable to write at the college level (Rose, 1985). For more than sixty years, the focus of college writing remained on correctness of grammar, usage, and mechanics (Rose, 1985). However, more recently composition theory has associated itself with learning theory, cognitive development, social cohesion, and the political empowerment (Villaneuva, 1997).

At least two events are associated with initiating the shift from focus on correctness of product to focus on process. The first was the interest in cognitive processes at both the National Academy of Sciences Conference (with Jerome Bruner as its director) at Woods Hole in 1964 and the Dartmouth Conference in 1966 at which group of American English teachers discovered the British view of writing as a process towards personal development and self-discovery (Villaneuva, 1997). The second was the need to find a new way to address the needs of the growing numbers of underprepared and untraditional students entering college in the 1970s (Villaneuva, 1997).

Table 1

Five Orientations to Learning

Aspect	Behaviorist	Cognitivist	Constructivist	Humanist	Social Learning
Learning theorists	Skinner, Tolman, Hull, Pavlov	Bruner, Ausubel, Davis, Feuerstein	Kolb, Dewey, Piaget, Gardner	Knowles, Mezirow, Chickering, Cross	Vgotsky, Freire, Belenky
View of Learning Process	Change in behavior	Internal mental process	Learning constructs reality	A personal act to fulfill potential	Interaction with and observation of others in a social context
Locus of learning	Stimuli in external evnerioment	Internal cognitive structuring	Interaction of mind and prior experience	Affective and cognitive needs	Interaction of person, behavior, and environment
Purpose of education	Produce behavioral change in desired direction	Develop capacity and skills to learn	Create knowledge of the world	Become self-actualized, autonomous	Model new roles and behavior, become liberated from oppression
Teacher's role	Arrange environment to elicit desired response	Structure content of learning activity	Create opportunities to experience world	Facilitate development of whole person	Model and guide new roles and behavior
Manifestation in adult learning	- behavioral objectives - competency-based education - learning centered	- cognitive development - schema theory - learning centered	- experiential learning - learning styles - developmental theory - multiple intelligences - learner-centered	- andragogy - self-directed learning - critical reflection - seven vectors	- socialization - mentoring - locus of control - collaborative learning

Adapted from Merriam and Caffarella (1991)

In the 1970s there was a movement toward process as opposed to product and the psychological view of the writer. Emig's 1971 book *The Composing Process of Twelfth Graders* heralded the new view of writers from that perspective (Villaneuva, 1997). In 1972, Murray encouraged teachers to be patient and look for students' real voices, that students and their classmates should review their own and each other's drafts, that students should find their own subjects, that they should have unpressured time to think (along with pressured time to meet the deadline), that drafts (as many as necessary) should not be graded, and that students should explore the writing process in their own way within the constraints of the course, and finally that "there are no rules, no absolutes, just alternatives" (Murray, 1972, p. 5).

Composition theorists such as Shaughnessey (1977), Flower (1989), and Hayes (1981) drew on the work of Vgotsky for the role of language in providing our concept of reality and Piaget and Perry for stages of development (Villaneuva, 1997). In 1979 Lunsford wrote that basic writers had not yet reached the stage of being able to think abstractly, draw inferences, or form concepts (Lunsford, 1979).

Emig (1977) reflected the cognitivist view when she wrote that "writing involves the fullest possible functioning of the brain, which entails the active participation in the process of both the left and right hemispheres" (Emig, 1977, p. 11). She also referred to the physiology of learning in the cortex and said that for writing and learning students needed to make connections and be active in the process (Emig, 1977). Similarly, Rose (1988) referred to whole-brain functioning in the writing process.

In 1976 Shaughnessey addressed the approaches of teachers to basic writers "guarding the tower, " "converting the natives," sounding the depths," and needing to get

on with in by "diving in," deciding that teaching basic writers to write well is important work in a democratic society (Shaughnessey, 1976). In 1977, Shaughnessey's *Errors and Expectations* classified the types of errors made by basic writers with the idea that student error patterns can be diagnosed and treated with instruction specific to the type of error. Shaughnessey also cites student lack of confidence as interfering with the writing process (Shaughnessey, 1977).

In 1982, Bizzell commented on the numbers of untraditional students entering college with inadequate writing skills in both the development of ideas and the basic grammar and mechanics. She explained that it was natural to interpret the deficiencies as a problem in thinking (Bizzell, 1982). She concluded that meeting the needs of the more underprepared students would require a reevaluation of the "relationship between thought and language" (Bizzell, 1982, p. 366).

One new approach came in the form of a movement away from focusing on students' deficiencies to helping them use writing to connect with their world. Berthoff (1984) wrote that instead of reducing basic writers to children, educators should "give them their language back" (p. 308). She emphasized that learners needed to be engaged in order to learn, and she referred to Freire's pedagogy of knowing as a model for helping students use writing to make meaning (Berthoff, 1984).

Another approach in response to the needs of underprepared students came in the form of collaborative learning (Trimbur, 1989). Bruffee (1984) wrote that both poorly prepared students and some students whose records would indicate they were well prepared who did not do well academically seemed to share a difficulty in adapting to the traditional classroom and teaching methods. He reasoned that if the traditional classroom

was the problem, an alternative to traditional techniques needed to be found, and one alternative was peer tutoring. Bruffee found that collaborative classroom group work also helped students learn from each other and become active in the writing process.

In the tradition of Freire, basic writing came to be seen for its value in connecting students to the bigger world. Bernstein (1998) writes of the value for Cambodian students in writing about transformative experiences. Shor (1987) collected several articles about using Freirian pedagogy for American students to aid in transformative learning.

Another new approach towards writing relates to the way the brain processes information. Articles and books such as *Writing the Natural Way: Using Right-Brain Techniques to Release Your Expressive Powers* promised to "turn the task of writing into the joy of writing" by tapping into the brain's natural processes for writing (Rico, 1983). The book devotes one chapter to the functioning of the brain in writing, especially in regard to right and left hemispheric differences. The book offers strategies from brainstorming ideas through clustering, organizing, accessing the creative mind, and revision, all from the perspective of brain functioning. Since the 1980s there has been some mention of neural activity and writing in the literature, especially through Smilkstein (1993, 1998) who has developed a grammar program using strategies from brain research.

Composition theory changed to meet the needs of underprepared students entering college after the 1960s. In so doing, it drew on learning theories of cognition, constructivism, humanism, and the social context. Additionally, there was an effort to tap into the natural processes of the brain. While learning and composition theory were following parallel paths, knowledge about how the brain functions was increasing.

Current Research in How the Brain Processes Information

Research from the fields of cognition (theories of how the mind processes information) and neuroscience (the physiology of the brain) is contributing to educational theory and is changing the way some educators think about learning. A detailed discussion of current brain research is beyond the scope of this study; therefore, the following is presented as an overview of research on brain functioning, especially in relation to education.

Studying the Brain

Records of brain maps were found in Egypt dating from 3,000 to 2,500 BC and during medieval times. World War I head-injured soldiers provided information linking injury to ability (or inability) to function. Then in the 1950s in his work with epileptic patients, Wilder Penfield found that when brains were stimulated with a mild electric current, conscious patients experienced vivid memories, leading researchers to believe that memories were stored in specific brain locations (Carter, 1998; King, 1997). However, recent research indicates that memories are stored in multiple places, any one of which, when stimulated, may activate other, related locations to give an "integrated, multimedia, experience" (Carter, 1998, 31). New technology has enabled researchers to study how the brain learns and processes information on the system, cellular, and chemical levels (Caine & Caine, 1994; Carter, 1998; Davis, 1997; Jensen, 1998; Kotulak, 1996; Sousa, 1994; Sylwester, 1995).

Today, scientists study the brain with more sophisticated technology. With Magnetic Resonance Imaging (MRI), they can obtain a three-dimensional picture of the brain, and Functional MRI allows researchers to see when an area of the brain is activated

by showing areas that have the most oxygen (which indicates a neuronal area is being fired). Positron Emission Topography (PET) scanners can identify areas of the brain in use by identifying areas with increased blood flow when radioactive markers are injected into the blood. Near-Infra-red Spectroscopy (NIRS) yields pictures of fuel use in the brain by measuring reflection from low-level light waves beamed into the brain. Electroencephalography (EEG) measures electrical patterns of brainwaves through electrodes places in the skull. And Magnetoencephalography (MEG) records magnet pulses give off from neurons as they become active (Carter, 1998).

Brain Physiology and Function

A total of about 100 billion neurons comprise the brain, 20 percent of which form the grooved outer layer called the cerebral cortex. Beneath the cerebral cortex is the white matter, made up of bundles of axons and glial cells that are thought to nourish the cerebral cortex. The inner part of the brain consists of the brainstem, which regulates autonomic functions such as breathing, and the limbic system, which is the emotional center (Carter, 1998; Sylwester, 1995).

If the cerebral cortex were spread out like a cloth, it would be about twenty-two inches square, about the size of a large dinner napkin (Carter, 1998; Davis, 1997; Diamond & Hopson, 1999; Sylwester, 1995). About two millimeters thick, the cerebral cortex consists of cells called neurons arranged in six layers and columns about the size of thin sewing needles, and each containing about one hundred neurons (Diamond & Hopson, 1999; Sylwester, 1995). Each neuron is capable of growing extensions called dendrites that connect with other neurons. It would take 30,000 neurons to occupy the space on the head of a pin, and each is capable of growing tens of thousands of dendrite

branches (Sousa, 1994). A neuron may interact with thousands of other cells, and the neurons and dendrites in a cubic centimeter of brain tissue would extend 400 miles if they were spread out in a line (Sylwester, 1995).

The outer layer, the cortex, is divided into four lobes with each lobe having a specific set of functions: (1) the occipital lobe processes visual information; (2) the parietal lobe deals with movement, orientation, calculation, and recognition; (3) the temporal lobes process sound, speech, some aspects of memory; and (4) the frontal lobes deal with higher order thinking, conceptualizing, judgment, and planning (Carter, 1998; Sylwester, 1995).

In addition, the brain is divided into two hemispheres, with each processing of information differently. In the 1960s, Sperry treated people with severe epilepsy by severing the corpus callosum, the major structure of nerve fibers that connects the left and right hemisphere and allows collaboration between hemispheres. The procedure helped with the epilepsy, but produced surprising results due to the very limited ability patients had in communication between the hemispheres. This research provided information on the specialized functions of the two hemispheres (Carter, 1998; Sylwester, 1995).

The right hemisphere is credited with the propensity to grasp wholes, is good at breaking down patterns, likes visual images, is more creative, and is more emotional, while the left grasps parts, processes information sequentially, likes words and symbols, and is more logical and analytical (Jensen, 1996). Researchers of split-brain reported that when the major vehicle allowing communication between the hemispheres was severed, patients found the equivalent of two personalities vying for control of behavior,

frequently manifested by an "alien hand" that acting through volition of the right hemisphere, which was often in opposition to the conscious will of the left hemisphere (Carter, 1998). On the basis of this research, Sperry concluded that people have within them more than one persona, and that in a normal person the dominant hemisphere (usually the left) decides which of opposing courses of action will be acted on, all beyond a person's conscious awareness (Carter, 1998).

Even more interesting, researchers found that when information was presented to the right hemisphere, the emotional impact but not the actual content registered in the left hemisphere (Carter, 1998). While in the 1960s Sperry and his contemporaries had only the behavior of patients to provide insight into how the brain operates when the corpus callosum is severed, today PET scans can be used to show how the hemispheres interact for various mental tasks (Sylwester, 1995). PET scans show that both sides of the brain are involved in most activities, that communication between the hemispheres work together to create "whole brain thinking" (Jensen, 1996). Jensen (1996) recommends that hemisphericity be a metaphor for understanding how we process information as opposed to looking for specialization in each hemisphere.

MacLean (1978) is credited with identifying three primary brain systems: the brain stem, the limbic system, and the cortex. The brainstem carries information from the spinal cord into the brain (Carter, 1998). It is considered the most primitive brain system because it evolved millions of years ago and is "like the entire brain of present-day reptiles" (Carter, 1998, p. 17). The brainstem regulates autonomic body activities such as breathing and heartbeat. On top of the brainstem is the reticular activating system which

responds to perceived threat or danger by releasing adrenaline throughout the brain (Carter, 1998). The brainstem also controls alertness (Carter, 1998).

The limbic system is sometimes called the mammalian brain because it evolved in mammals (Carter, 1998). Emotions are generated in the limbic system. Also, the part of the limbic system called the thalamus determines if incoming information will come to conscious attention or not. If so, it sends the information to other parts of the brain for processing. Within the limbic system, the hippocampus helps with long-term memory, and the amygdala is associated with the emotion of fear (Carter, 1998).

Incoming information that merits active attention proceeds through two processing systems: the limbic system and the slower analytic system of the frontal lobes of the cortex. The limbic system assesses emotional impact, and the frontal lobes control attention and make connections to previously stored information that relates to the stimulus. If information is determined to have emotional impact and if it relates to previously known and experienced information, the information may be stored in a short term memory area until it is determined whether to move it to long-term memory, all beyond conscious thought and intent. Besides processing information from outside the individual, the brain processes information it generates in thought, and it doesn't distinguish between the two (Sylwester, 1995).

Exactly how memories and ideas make their way into long term storage is not clearly understood (Sylwester, personal communication, Apr. 14, 2000); however, it is known that processing time is required for information to "stick." Jensen (1998) says that focused learning experiences need to allow time to process and create new meaning. This process needs to happen internally, and sometimes "the brain continues to process

information before and long after we are aware that we are doing it. As a result, many of our best ideas seem to pop out of the blue" (46). Further evidence of nonconscious processing of information was reported by Sternberg of Bell Laboratories (reported in Jensen, 1996, p. 14). Sternberg found that the brain continues to process alternative prospects to a question or train of thought even when conscious thinking has ended. The brain literally practices thinking even on a subconscious level (Caine & Caine, 1997).

The brain uses two systems to process memory: taxon and locale (Caine & Caine, 1997). The taxon memory system (also called the "semantic," "declarative," or "linguistic" memory [Jensen, 1996, p. 205]) is used for remembering unrelated, meaningless, isolated pieces of information and depends on memorization and rehearsal, like learning the multiplication tables. In contrast, people can recall events effortlessly using the locale memory system (also called "contextual" and "episodic" memory system [Jensen, 1996, p. 205]), which provides recall of events such as what a person had for dinner yesterday. Caine & Caine (1997) say that the locale memory system "is always engaged, is inexhaustible, and motivated by novelty," and that "meaningful learning occurs best through a combination of both approaches to memory" (107). Jensen (1996) and Caine & Caine (1997) recommend the teaching strategy of activating students' locale memory systems by telling stories, creating real life situations related to concepts being taught, and using thematic mapping.

The Brain and Learning

First and foremost, the research says that in order to learn, a brain needs to meet its physiological requirements (Jensen, 1998; Smilkstein, 1998; Sousa, 1994; Sylvester, 1995). The brain needs adequate water, adequate food and nutrition, rest, and just enough

stress to keep an individual interested. Too many students, elementary through college, do not learn to their potential because they are not in class with brains ready to learn. Dehydration, fatigue, and poor nutrition contribute to student ability to learn (Caine & Caine, 1994; Jensen, 1998; "New Study," 2003; Sylwester, 1995). According to Kotulak (1996), undernourished children may appear normal, but their condition results in fatigue and disinterest. The good news is that the condition is easily reversed if caught early (p. 52).

Some cognititivists and neuroscientists identify the physical event that occurs as a result of learning: the growth of neuronal dendrites and the establishment of connections between neurons at junctures called synapses (Caine & Caine, 1994; Jensen, 1998; Kotulak, 1996; Smilkstein, 1993, 1998, 1999; Sousa, 1993, 1995; Sylwester 1995). The neuron itself has three parts: the cell body, branches called dendrites, and an axon. A neuron may interact with thousands of other cells and make over 15,000 synaptic connections with neighboring cells, some making over 200,000 connections, building a network "as impenetrable as the enchanted forest in 'Sleeping Beauty'" (Diamond & Hopson, 1999).

Research with rats indicates that enriched experiences result in more brain connections and heavier brains. In the 1960s Mark Rosenzweig from the University of California at Berkeley and William Greenough from the University of Illinois reported that rats "enjoying the high life" had heavier brains and thicker brain structures, and increased branching of neuronal projector (as cited in Diamond & Hopson, 1999). Besides that, those same rats performed better on learning tests (Van Praag, Kemperman, & Gage, 1999). In her work with rats, Marian Diamond (Diamond & Hopson, 1999)

proved that rats raised in enriched environments grew more connections and thicker cortexes than rats raised in impoverished environments. Even more startling was the fact that rats which were moved to a less stimulating (i.e., more boring) environment showed thinning of the cortex in as little as four days (Diamond & Hopson, 1999).

Each person is unique in that dendrites and connections grow in relation to that individual's experiences, and researchers say that the brain has "plasticity" due to the fact that it actually grows connections as a result of experience with the world (Caine & Caine, 1994; Davis, 1997; Diamond & Hopson, 1999; Sousa, 1994; Sylwester, 1995). For example, Elbert, et al. (1995) used magnetic source imaging to study the cortical density in the brain area of the fingers of the left hand in nine musicians (six violinists, two cellists, and one guitarist) compared to cortical density of a control group. They attribute the fact that the musicians had greater cortical density in the brain area corresponding to fingers of the left hand to plasticity associated with the increased activity of the fingers of the left hand in playing their string instruments. Elbert, et al. (1995) cite other studies that show neural plasticity in monkeys and humans.

Cardoso and Sabbatini (2002) write that knowledge that the brain physically changes in response to the environment is important for people of all ages. The research indicates that enriched sensory environments may positively affect the cognitive and memory capabilities of children later in life. Also, people with brain lesions "may recover part of the lost functions by being subjected to intense and diverse sensory and mental stimulation, in analogy to physical therapy for weak muscles" Cardoso and Sabbatini, 2002, p. 3). Finally, Cardoso and Sabbatini (2002) say that in the future it may be

possible to encourage dendrite growth through both food and drugs as well as through environmental stimulation.

Dr. Michael Merzenich ("A Learning Revolution," 2000) has developed a program of manipulating brain plasticity to improve the language skills of school children. His training program enables the brain to form new networks, thus helping children overcome problems related to dyslexia and other language disabilities. Merzenich believes that similar techniques, possibly with the addition of neurotransmitters, may effectively help schizophrenics and people with autism ("A Learning Revolution," 2000).

Researchers have studied growth of dendrites and connections between neurons. Stages of rapid growth of neuronal connections have been found to coincide with periods of skill and cognitive development such as language development, crawling, and conceptual development (Diamond & Hopson, 1998; Sylwester, 1995). At the same time, neural pruning has been documented when connections disappear through disuse (Carter, 1998; Diamond & Hopson, 1998; Sylwester, 1995).

Diamond and Hopson (1999) compare the growth of dendrites to the growth of tree branches, and counts the level of branching, with more the first three levels of branching related to lower level thinking, and the fourth to eighth levels of branching related to higher order thinking. Dendritic growth in relation to educational achievement has been examined through autopsy studies conducted by neuroscientists from the University of California, Los Angeles, who found 40% more connections in the brains of university graduates who were mentally active compared to high school dropouts (Jensen, 1996; Kotulak, 1996).

Establishing initial learning, whether it is a motor or intellectual activity, takes practice and effort to build the initial connections through dendrites and synapses. Afterward and with each continued use of the activity, the connection becomes stronger and faster - Smilkstein (1995) reports that subsequent events of an activity results in fatter dendrites, which conduct information more quickly. Also, with repetition of a task or thought, dendrites grow bumps or spines, which hold information/memory and also make it easier to subsequently access the information. Smilkstein (1995) says,

> Learning, in fact, is nothing other than our brain's growing new dendrites and synapses--and constructing elaborate neural networks between neurons--specifically for whatever we are specifically attending to, specifically experiencing, specifically practicing; in short, our brain tailor-makes new dendrites, synapses, and neural networks for each new specific thing while we are attending to, experiencing, or practicing it (41).

Smilkstein (1993) also says "All subsequent learning, then, is successively and cumulatively constructed on--connected to--what had previously been constructed/learned. These brain structures do not merely represent our knowledge, they *are* our knowledge" (p. 3).

Kotulak (1996) also states that using the mind causes physical changes in the brain and builds new synapses. He says, "Such physical changes can occur within seconds, as when we shift attention, or they may take hours or days as some memories are cast into the biological ingots that last a lifetime" (p. 157).

Jensen (1998) is comfortable assigning a number to processing time, saying that new content requires an average of 2-5 minutes of practice and rehearsal for every 10-15 minutes of instruction while review of material may only take a minute for every 20 minutes of instruction. However, Smilkstein (personal communication 16 Apr. 2000)

says that the time required for mastering knowledge or a skill is unique for each person and depends on the topic/skill. This is because each person's brain is uniquely configured with strengths in processing information in some areas and weakness in others, resulting in the fact that person's genetic make-up contributes to the ease of learning material (Kotulak, 1996; Smilkstein 1995, Sylwester, 1995). Additionally, a person's experiences help shape the brain through growth of neural connections that occur with processing of information which can strengthen processing of future information (Diamond & Hopson, 1999).

Smilkstein (1995) sees developmental students facing two barriers to new learning. First, they have not built a foundation of knowledge on which to build new knowledge. She says, "The new material is beyond their level of dendrite growth; the new material is literally and physiologically 'over their heads.' To catch up, they need, first, to construct the lower foundation dendrites for each skill and concept, including dendrites/knowledge related to academic life and studying school subjects" (p. 6). The second barrier is that developmental students need to overcome emotional trauma regarding their past learning failures. She says they can do so by thinking of learning in terms of dendrite growth as opposed to factors beyond their control.

Emotion and Learning

Also, the research says that emotions play an important role in learning. Sylwester (2000) reports that before people become engaged in learning, they have to attend, and people only attend to things that have emotional meaning. Information coming into the brain first reaches the limbic system, which is the center of emotion. If the information has emotional impact and/or connects with previous knowledge, the information comes to

conscious awareness. If not, the individual does not attend to the stimulus (Sylwester, 1995 & 2000). In other words, an individual's emotional system regulates attention.

Too much stress will interfere with an individual's capacity to perform intellectual tasks (Caine & Caine, 1994; Jensen, 1998; Sylwester, 1995). MacLean proposed the triune brain model which states that the brain operates on three levels: the most primitive autonomic system that regulates life support systems unconsciously; the limbic, or emotional, system; and the higher level cognitive processing system of the cortex (as cited in Caine & Caine, 1994; King, 1997; Sylwester, 1995). According to the triune model, stress causes a system to operate in survival mode, to close down access to higher order thinking in order to move into "fight or flight" mode. McLean called this "downsizing," and it is been proposed that downsizing interferes with learning (Caine & Caine, 1994; King, 1997; Sylwester, 1995).

Also, negative emotions over time damage a person's ability to learn (Sapolsky, 1996). Vincent (cited in King, 1997 & Sylwester, 1995) reports that chronic stress triggers the chemical cortisol, which in turn destroys neurons in the hippocampus, affecting learning and memory. Gazzaniga (qtd in King, 1997) says, "even short-term elevation of cortisol in the hippocampus triggered by stress hinders the human brain's ability to distinguish between important and unimportant elements of a memorable event (283).

Stress plays a bigger role in learning than previously thought, and in its negative form creates a barrier to students reaching their potential in school. Sylwester (1995) says that

> a sense of self-esteem and control over one's environment are important elements in managing stress. Although highly evaluative and authoritarian school

> environments may promote such institutional values as economy, efficiency, and accountability, they may do so at the cost of increasing unproductive emotional stress in students and staff. (p. 77)

Kotulak (1996) speaks of the new epidemic being "brain damage caused by bad experiences which can increase the risk of developing such illnesses as aggression, language failure, depression and other mental disorders, asthma, epilepsy, high blood pressure, immune system dysfunction, and diabetes" (p. 35). According to Kotalak, "stress caused by bad experiences can actually affect genes, turning them on or off at the wrong times, forcing them to build abnormal networks of brain cell connections" (p. 36). Sylwester (1995) echoes Kotulak's concern when he says that chronic stress can lead to the destruction of neurons associated with learning and memory and that stressful experiences can make it difficult for people "to distinguish between the important and unimportant elements of a memorable event" (p. 38). Kotulak states that the worst stress is "violent abusive surroundings over which children have no control" (p. 41). Additionally, "threatening environments can trigger imbalances of . . . chemicals in people, laying the biological foundation for a lifetime of aggression or violent behavior" (p. 98). A secondary effect of stress is that those who live with constant stress tend misinterpret clues from others such as "taking constructive criticism as an attack on their self-worth" (Kotulak, 1996, p. 43).

While negative emotions sabotage learning, positive emotions enable learning to occur. Smilkstein (1995) goes on to say, "In contrast, hormones produced by positive emotions like confidence and curiosity facilitate synaptic connections and thereby facilitate thinking and remembering as correlates of the physiological facilitation" (p. 3). Jensen (1995) notes that positive stress, as in celebratory events, triggers adrenaline

which may help memory stick. Sylwester (1995) states that emotion is a very important consideration in learning because it "drives attention, which drives learning and memory" (p. 72). Kotulak (1996) recommends giving "children a sense of self-worth and to teach them they are not helpless" (p. 42). Children learn well in classrooms that acknowledge (as opposed to ignore or deny), emotions as well as foster positive emotions. Sylwester (1995) says,

> Joyful classroom environments that encourage supportive environments that elevate endorphin levels create an internal chemical response that can increase the possibility that students will learn how to solve problems successfully in potentially stressful situations. (p. 38)

Brain-based learning can explain how some good intentions somehow didn't automatically translate to success. One example is the failure in the 1970s of efforts to encourage success through attempting to raise students' self-esteem. Caine & Caine (1994) point out that building positive feelings "without regard to performance, creativity, and intellectual understanding" is ineffective (p. 137). They also state that it takes many successes to achieve a genuine shift in self-esteem because the brain may contain "hundreds and perhaps thousands of environmental triggers that support negative beliefs about the self" (p. 137).

Brain Research in the Media

The general public regularly hears news of new brain research through newspaper and magazine articles, books, and television. Today's media report of such things as researchers locating areas of the brain related to crime, addiction, obesity, shyness, face recognition, and so on. Also, autopsy studies show how brain structure relates to behavior and intelligence. For example, in June of 1999, the *ABC News* released an article

reporting that an autopsy showed that an area associated with mathematics reasoning was 15% larger in Einstein's brain than in the average person's brain (Chang, 1999).

A newspaper article originating from *The New York Times* ("Yoga," 2002) reported on the effectiveness of Yoga in relieving stress and helping fourth graders concentrate in school. Daniel Amen's book *Change Your Brain Change Your Life* (1998) discusses the connection between the brain and psychological problems as well as strategies for stress relief and to overcome negative thinking habits contributing to stress. And at a medical clinic waiting room I found an article relating the benefits of socializing with others with improved mental health ("Widening," 2000).

Good news about learning and aging is also readily available to the general public. In 1999 the *Scientific American* published research from Kemperman and Gage (1999) about the adult brain's ability to produce new nerve cells in the hippocampus which contributes to memory and learning. An Internet search on GOOGLE using the search terms "learning" and "brain" and "aging" in April, 2003, resulted in 103,000 sites. One of those sites presented extensive information from Wetzel and Harmeyer's 1999 book *Mind Games: The Aging Brain and How To Keep It Healthy,* including examples of mind games and an animation of two neurons making a connection to form a memory, including the formation of dendrite spines (*Mind Games*, n.d.).

In 2002, *Time Magazine* (Lemonick & Mankato, 2002) published an article about David Snowdon's sixteen-year study of 678 nuns from seven convents in Minnesota. Snowdon is studying the aging process of the nuns, especially concerning in regard to their incidence of Alzheimer's. Snowdon's data consists of each nun's autobiography written upon entry into the order, annual logs of the nuns' level of cognitive functioning,

and physical examinations of their brains upon their deaths. So far he has confirmed that a deficiency of the nutrient folate is correlated with a higher incidence of Alzheimer's Disease as well a finding support for the idea that brain stimulation through life helps people avert the symptoms of Alzheimer's in old age. He has also found a higher incidence of Alzheimer's in people who have had evidence of having suffered strokes. A surprising finding in his study comes from the autobiographies, written as many as sixty years ago: those whose autobiographies contained high idea density (the number of ideas per 10 written words) and grammatical complexity were less likely to exhibit symptoms of Alzheimer's in later life. Snowdon claims to be able to predict with 85% accuracy which nuns would show symptoms of Alzheimer's by reading the essays alone (reported in Lemonick & Mankato, 2002).

Information on new research about the brain certainly is available to the general public, and it has also impacted learning and teacher theory. New dimensions of brain theory include the ideas of plasticity, the view of the brain as a parallel processor, and the importance of emotions in brain function.

Elements of Brain-Based Learning

Jeffrey King (1997) refers to Georgi Lozanov's work with accelerated learning in the late 1960s as a beginning point for brain-compatible theory. Lozanov, working in Bulgaria, achieved remarkable results with students learning a foreign language by presenting materials in such as way as to facilitate their assimilation. Lozanov believed that the brain processed information through both conscious and unconscious means, and he designed and delivered his lessons to make learning as effortless as possible. King (1997) reports that Lozanov's methods enabled students to learn 500 words per day with over 90% retention a year later.

In his article, "Brain Function Research: Guideposts for Brain-Compatible Teaching and Learning," King (1997) says that new research in how the brain learns calls for a new paradigm in education. King (1997) summarizes the salient elements of brain-compatible learning in the following:

> In its broadest usage, a brain-compatible approach applies techniques and insights from accelerated learning, proster theory, the triune brain model of cognitive function, taxon/locale memory theory, discoveries about the limbic system's and emotion's role in cognition, the uniqueness of individual learning styles, and a host of research findings based on an examination of how the human brain works. Good college instructors intuitively do many of the things suggested by this research. The process of collecting, codifying, and publishing the implications of the research, however, means any professor exposed to the material would have a clear model of brain-compatible methodologies. (p. 278)

Like cognitivists and schema theorists in the 1980s, Leslie Hart (1992) proposed his proster theory that learning is built on the process of detecting and making patterns. He says that new information is best learned when liked to existing knowledge. According to Hart, new material needs to be presented so that it can connect to previous knowledge in order to have meaning and be processed by a learner. Otherwise the material will not "stick" (Hart, 1992).

MacLean's (1978) theory of the triune brain divides the brain into three sections: the reptilian brain (composed of the brainstem which controls instinctive behavior), the mammalian brain (the limbic system in which emotional behavior is regulated), and the neocortex (seat of higher order thinking and learning). According to MacLean, when threatened, a person "downshifts," or moves from the neocortex to the mammalian (emotional) and reptilian (instinctive) levels of functioning as a means of survival. Therefore, when threatened the human organization is incapable of higher order thinking and reasoning (Caine & Caine, 1994; King, 1997; MacLean, 1978; Sylwester, 1995).

Brain-based concepts as conceptualized by several researchers include the following:

1. That the brain requires adequate food, water, and rest in order to function at its best (Caine & Caine, 1997; Diamond & Hopson, 1999; Jensen, 1995; Sylwester, 1995),

2. That emotion can enhance or inhibit learning (Caine & Caine, 1997; Davis, 1997; Hart, 1992; King, 1997; Sylwester, 1995),.

3. That a learner must be active (Cardellichio & Field, 1997; Hart, 1992; Smilkstein, 1998).

4. That new learning builds on prior learning (Cardellichio & Field, 1997; Diamond & Hopson, 1999; Hart, 1992; Smilkstein, 1998),

5. That the brain naturally looks for patterns (Caine & Caine, 1997; Cartullichio & Field, 1997; Hart, 1992) and is attracted to novelty (Caine & Caine, 1997).

6. That learning is a social activity in that the brain responds to the interaction with others (Caine & Caine, 1997),

7. That the brain is "plastic" in the sense that it grows and develops in response to its environment and experience, which, along with genetics, makes each brain unique (Diamond & Hopson, 1999),

8. That prolonged stress inhibits the capacity to learn and physically destroys brain cells (Diamond & Hopson, 1999; King, 1997; Sapolsky, 1996; Sylwester, 1995),

9. That the brain stores information in more than one place (Davis, 1997; Diamond & Hopson, 1999; Kotulak, 1996),

10. That the brain processes information beyond the learner's awareness and that reflection is an important part of learning and processing information (Caine & Caine, 1997),

11. That the brain has two memory systems, one relying on facts and memorization of unrelated information and the other (which is always engaged and does not need rehearsal) being inexhaustible and capable of recalling experience instantly (Caine & Caine, 1997; Jensen, 1998),

12. That the brain perceives information both holistically and by parts and details (Caine and Caine, 1997),

13. And that learning is enhanced by challenge and inhibited by threat (Caine & Caine, 1997).

Caine and Caine's Principles of Brain-Based Teaching

Caine and Caine (1997) identify categorize knowledge into three types: surface, technical or scholastic, and dynamical. Surface knowledge is that acquired through rote memory (the taxon system), and although its value lies in enabling people to carry out routines and procedures (such as programming a computer) successfully (Caine & Caine, 1997). Caine and Caine (1997) define technical or scholastic knowledge as learning content in a discipline of subject without a deep understanding. Caine and Caine (1997) say that meaning comes with dynamical knowledge, which includes both intellectual and emotional understanding on a deeper level. Caine and Caine (1997) argue that through application of brain-based principles, students can go beyond surface knowledge of the traditional school program to achieve dynamical knowledge.

Dynamical knowledge can be acquired through (1) orchestrated immersion of the learning in complex experience, (2) active processing of experience, and (3) relaxed alertness (Caine & Caine, 1997). The Caines (1997) create orchestrated immersion through stories, attention to the context of the learning situation and the environment, through attention to the social aspect of learning, and through a variety of sensory input. Active processing enables people to create personal meaning by thinking critically, questioning, solving problems, exploring parts and wholes, and exploring alternative points of view (Caine & Caine, 1997). Relaxed alertness is achieved by challenging students in low-threat situations so that they will feel comfortable to take risks without feeling the need to be defensive (downshifting) (Caine & Caine, 1997).

The Caines' (1997) teaching strategies could be summarized as including the following activities: (1) narratives and stories, (2) an effective context for learning, (3) collaborative activities for the social aspect of learning, (4) critical thinking, (5) questioning, (6) problem-solving activities, (7) attention to parts and wholes, (8) exploration of alternative points of view, and (9) high challenge/low-threat situations.

Criticisms of Brain-Based Learning

Jensen (n.d.) addresses five complaints against brain-based learning theory. He finds the criticism that the findings are often exaggerated and misinterpreted valid. He says brain research proves nothing; there is no brain-based research that justifies every strategy of so-called "good teaching." However, he continues that studies provide insight that can suggest certain actions. When people say there is nothing new in a brain-based approach, Jensen reminds them that only 40 years ago good teaching was defined as all-lecture, content-laden classes, clean desks, quiet students, with little movement.

Jensen (n.d.) says that while it is true that some teachers have been using brain-compatible strategies for centuries, most educators have been moving towards a more brain-friendly approach. Important recent discoveries relate to the fact that the brain can grow new cells; interactions and social status impacts stress levels (social brain); the impact of hormones on cognition; the influence of movement on learning; brain plasticity; memory; attentional brain, prefrontal cortex, attention, and ADD; emotional brain (including the prolonged effect of stress); the role of time in the learning process; the role of feedback in forming neural networks; the artful brain, music and arts; the brain-body connection; the developing brain – value of the first 3 years; the role of nutrition in learning and memory; and the chemical brain.

Jensen (n.d.) says that discoveries about learning come from many areas. Educators need to and ought to combine the findings of the brain/mind field with the fields of cognitive science, psychology, neurobiology, and neuroscience. He says the different fields conduct research on the same thing at different levels: the molecular, the genetic, and the cellular. Jensen points out that we now know enough about the brain to justify specific strategies that only a few years ago were just good ideas without scientific basis. For example, scientific research now provides "irrefutable" evidence that "embedding intense emotions (like celebration or drama) into an activity may stimulate the release of adrenaline which may encode the memory of learning much stronger" (Jensen, n.d., p. 3)

Criticism # 3 – brain research is tenuous and changes too rapidly to be of value. Jensen responds that every dynamic field is changing fast (medicine, technology, genetics, communications) – and the changes happen because in generally, early, cutting-

edge studies tend to be incomplete. The changes are really clarifications that result from new research.

Criticism #5 – brain-based learning is confusing, one person says one thing, another says the opposite. Jensen agrees, better sharing and networking needs to occur so all are on the same page. Many ill-informed educators are still confused about some learning basics.

A neural-based curriculum can address the needs of developmental students in a comprehensive way. Instruction would have to begin with the students' current skill level in writing. Because the brain looks at the big picture and relies heavily on visual information, diagrams and mind maps would be used to show relationship of ideas. Also, to stimulate attention, students would be presented models of essays on high-interest subjects and assigned activities that would stimulate interest. Lecture would be minimal so that students could actively and collaboratively research projects of interest to them.

The learning environment would be structured with little threat to prevent or minimize downshifting, and the material would be challenging (with appropriate support) to maintain student interest and increase the self-concept when mastered. Because the brain integrates information, concepts feeding into the unit would be threaded into previous lessons to reinforce previous material and pave the way for introducing new material. Learning activities would involve a variety of senses to maximize processing of information. Finally, students would be taught to think about strategies for writing so that they don't operate solely in a trial and error mode. Any of these strategies alone can certainly be found in the work of Gardner (1993), Piaget (1992), Rose (1989), Sternglass

(1997), Gardner (1993), Vgotsky (1962), and other educators and writers who use sound teaching methods.

Developmental Education and Brain-Based Theory

Like all faculty, developmental educators want to see their students succeed. More recently, states are tying funding to student success, adding pressure to college to document their success with students. To help students overcome barriers to success, developmental English instructors attend to students' emotional needs, encourage students' active participation in their learning, attempt to build on students' beginning skill level, present models and patterns for writing, develop activities that interest adults, develop metacognitive skills, encourage reflection on learning, and incorporate group activities in the classroom (Roueche & Roueche, 1999b). In fact, it would be easy to say that developmental writing instructors encourage their students in the ways endorsed by brain-compatible learning theory.

However, too many developmental students, and especially minority students, are unsuccessful (McCabe, 2000; McCabe & Day, 1998; Roueche & Roueche, 1999). Some attribute it to the students' background and personality factors related to learned helplessness and lowered expectation of success and identification with an academic environment (McCabe & Day, 1998; Roueche & Roueche, 1999a). Others cite an academic system that does not reach students' learning styles (Caine & Caine, 1997; Maxwell, 1997; Smilkstein, 1995; Sylwester, 2000). Caine and Caine (1997) say that even though educators are looking for better methods of delivering information, they still operate in a behaviorist frame of reference in that they teach in the standard, linear way: deliver lesson, supplement with practice and rehearsal, maintain discipline through

effective classroom management, and assess in standardized ways. The result, they say, is that the learners, rather than given opportunities to direct their learning, are restricted by an educational system that denies their "own purposes and meanings, even though they are a critical part of the learning process"(Caine & Caine, 1997, p. 42). One thing wrong with some of our developmental students is that they have had

> traditional lecture- and teacher-centered schooling without having been prepared to learn in this mode. . . . students who have not been readied for this mode of schooling can fail to thrive in it. As a result, there is a gap—often a great one—between what our students are capable of learning and their low level of academic performance. (Smilkstein, 1995, p.2)

Also, because childhood is such an important time to boost brain functioning and learning, most of the application is understandably geared to children. However, we now know that adults continue to grow dendrites and make new neural connections throughout life (Caine & Caine, 1994; Cardoso & Sabbatini, 2002; Diamond & Hopson, 1999; Jensen, 1996).

Contemporary researchers in developmental education such as Roueche and Roueche (1993, 1999a, 1999b) and Boylan (1985, 1995, 1999) identify the unique needs of developmental learners, including the barriers they bring with them to the educational setting. Scientists who study the brain have found the physical basis for two of those barriers to learning: learned helplessness and blocking. When they experience learned helplessness (Roueche & Roueche, 1993), people feel that their effort does not result in success, so they give up trying. Kotulak (1996) states that children with low activity in their left frontal cortex are "more apt to believe that when bad things happen to them it's their own fault" (p. 53). Another barrier to learning is blocking, when students do not

incorporate new ideas into their thinking. Smilkstein (1995) describes the physiological experience of blocking when she says,

> Negative emotions such as fear and anxiety bring into the brain various hormones (as at traumatic moments adrenaline floods our body) which inhabit the synaptic connections between neurons, inhibiting the electrochemical flow between neurons and thereby inhibiting thought and memory as correlates of this physiological inhibition. . . . This would explain the phenomenon of knowing everything before the test and then having our mind go blank when we pick up the test. (p. 3)

Since the 1980s, cognition has found its way into the teaching of college English, as seen in the works of Mike Rose. Rose (1989) describes the experience of many developmental college students:

> Let me try to explain how it feels to see again and again material you should have once learned but didn't....The particulars will vary, but in essence this is what a number of students go through, especially those in so-called remedial classes. They open their textbooks and see once again the familiar and impenetrable formulas and diagrams and terms that have stumped them for years. There is no excitement here. *No* excitement. Regardless of what the teacher says, this is not a new challenge. There is, rather, embarrassment and frustration and, not surprisingly, some anger in being reminded once again of longstanding inadequacies. No wonder so many students finally attribute their difficulties to something inborn, organic: "That part of my brain just doesn't work." Given the troubling histories many of these students have, it's miraculous that any of them can lift the shroud of hopelessness sufficiently to make deliverance from these classes possible. (p. 31)

In *Lives on the Boundary,* Rose (1989) describes his difficulty as an underprepared high school student:

> It wasn't just that I didn't know things—didn't know how to simplify algebraic fractions, couldn't identify different kinds of clauses, bungled Spanish translations—but that I had developed various faulty and inadequate ways of doing algebra and making sense of Spanish. (26-27)

Rose (1989) goes on to chronicle his eventual success in college and career as an English professor at UCLA, dedicating himself to helping developing writers who remind him of himself when he attended Loyola University:

> I was struggling to express increasingly complex ideas, and I couldn't get the language straight: Words . . . piled up like cars in a serial wreck. I was encountering a new language – the language of the academy—and was trying to find my way around in it. (p. 54)

In his work with developmental writing students, Rose (1989) reminds himself of Jerome Bruner's dictum "'Any subject can be taught effectively in some intellectually honest form to any child at any stage of development'" (142). Today, new knowledge about how the brain learns gives Bruner's words new meaning.

However, in order to learn, students need to a supportive system, a learner centered system. Caine & Caine (1997) say that the current belief structure about education denies the learner's own purposes and meanings, even though they are a critical part of the learning process. Learners' ability to solve problems is impeded, they encounter feelings of helplessness, they tend to revert to early programmed behaviors indicative of conformity to the status quo. Design of the educational system induces downshifting in administrators, teachers, and students. The combined effect is to reduce the capacity of participants at all levels to think and act "out of the box."

According to Maxwell (1997),

> high school teachers and college professors are subject matter specialists and have not been as concerned with teaching students how to learn their subjects. As a result, many of today's high school students graduate convinced of one thing – that they can't learn some subjects...today we call this having low self-efficacy, and it means that college instructors must first somehow find a way to convince students that they are capable of learning before they can teach them how to improve their skills." (p. 2)

We all come to the classroom from our individual paradigms and with our view of learning. Some say that behaviorism dominants the educational scene today. Caine and Caine ("Research," n.d.) discuss frames of reference through which educators and psychologists and neuroscientists see the world. There is a strong tendency to assume a very traditional linear view of teaching as the model they address, which is the traditional delivery model of an authoritative figure (instructor) dispensing information upon which students will memorize the information for a test. Caine and Caine ("Research," n.d.) note that many educators are just looking for more ways to do the same thing, but that a paradigm shift needs to occur in which students become the directors of their learning.

Caine and Caine (1997) identified three perceptual orientations of faculty when they attempted to implement brain-based curriculum into a school system. The three orientations reflected shifts in perceptions. They felt that the most brain-based perceptual orientation is what will be needed for the 21st Century:

> They will need to have the self-efficacy to deal with a fluid, yet frequently dysfunctional, system. They will need to have mastered the art of facilitating self-organization by students and others. They will need to have sufficiently broad cognitive horizons to be able to integrate new ideas and new information and to facilitate their introduction into ongoing and dynamic student experience. They will need to be able to face and know themselves and interact authentically with the people with whom they deal. And they will need to engage in the deep reflection and self-reference that makes constantly growing and adapting to a rapidly changing world (p. 226)

The Caines (1997) say that meaningful learning requires a combination of instruction and experience, and the biggest shift that education needs to make is that of finding ways to bring relatively authentic experience into schooling. They also say that

the standards debate will never be adequately resolved until the nature of learning is better understood.

Research on Application of Brain-Based Principles to Educational Settings

With knowledge of brain-based principles so readily available, it is no surprise that researchers have attempted to study its effect. The following studies address either cognitive strategies for writing that were not considered brain-based, specific strategies for student success using brain-based principles, or the larger effect of brain-based principles from a faculty perspective.

Cognition and Writing

The following studies investigate the relationship between cognition and writing. Goldman (1980) investigated classroom environment for student success, Meiser (1984) investigated the effect of teaching process analysis in a writing class, and Ruzicka (1998) investigated cognitive style (field dependence/independence) in a writing class.

Goldman (1980) explored community college reading students' cognitive and affective needs to identify the type of classroom environment that would enable adults with poor reading skills to succeed and persist in college. She concluded that the best environment for student success was recognition of students' socio-emotional needs and creating dynamic group processes.

Meiser (1984) compared two groups of unskilled college composition students, one taught with a traditional method, and one taught with a focus on writing strategies and process awareness. The students in the traditional method group primarily used a grammar workbook for instruction. The students in the process group received direct

instruction in writing strategies for the composing process. The results on pre/post expository writing, grammar and process awareness tests favored the process approach.

Ruzicka (1998) compared results of using individualized teaching methods for developmental composition students with of the students identified as field-independent and the other two as field dependent. The study showed similarities in enjoyment of writing when selecting topics of deep personal interest, consistency in the writing process and writing strategies regardless of assignment type. The only difference was in more sentence complexity for the field independent students. Ruzicka concluded that because there were no differences in most characteristics, cognitive style can be considered one of many factors related to student success.

Brain-Based Principles and Student Success

The following six studies address incorporating visuals in instruction (Dubes, 1987; Williams, 1999), effect of incorporating a learning style approach to teaching (Fabien, 1984; Miglietti & Strange, 1999), and the effect of providing students instruction in learning techniques (Wiles, 1997; Rini, 1990).

Dubes (1987) and Williams (1999) explored the use of visuals in instruction through posters and graphics and color. Dubes (1987) compared delivery modes of lecture, discussion, and use of posters for instruction of adults ages 59 to 90 at nutrition sites. The poster presentation resulted in significantly higher retention of information than either the lecture or structured discussion. Williams (1999) found that including mindmapping and use of graphics and color in a training course for a large, high-tech corporation helped participants become better learners.

Fabien (1984) and Miglietti and Strange (1998) studied the effect of incorporating strategies related to learning styles with underprepared community college students. Fabien (1984) studied the effect of using a learning styles approach to teaching composition by comparing two remedial college composition classes, one of which incorporated a learning styles approach. She found no difference between groups in pre/post writing sample; however, only two of the seventeen students in the non-learning style class improved in their attitude toward writing survey while all twenty of those in the learning style class improved in their attitude toward writing survey. Miglietti and Strange (1998) examined the effect of learning styles, teaching styles, and remedial course outcomes for underprepared adults at a two-year college. They found that underprepared students preferred to view the instructor as the authority in the classroom, but that "learner-centered classes resulted in significantly higher grades, and greater overall satisfaction" (p. 7).

Rini (1990) hypothesized that providing university students with knowledge and techniques about integrating emotional, psychological, and intellectual processes in their learning would improve their GPAs and academic orientations. The result was that although there was an improvement in orientation to learning in the experimental groups, there was no significant difference on GPA between the experimental group and the control group. Rini (1990) hypothesized that a follow-up study would show improvement in GPA as a result of improved orientation to learning.

Wiles (1997) examined the effect of taking a Cognitive Strategies class for under-prepared adults returning to school for academic upgrading. Using an experimental design with pre and post testing, Mulcahy found that the experimental group

demonstrated greater positive change in perception of success for the English classes, with no significant difference in perception of control.

In the six studies, only one (Miglietti & Strange, 1998) reported improved grades, while all clearly resulted in positive response in attitude, satisfaction, and/or learning skill of the students.

Educator Response to Brain-Based Learning

The following studies investigate the how teachers respond to instruction in brain-based theory. They examine observable teacher behavior with students and the effect of brain-based instruction for students.

Frank (1983) investigated knowledge of brain-based concepts and application of their principles with 711 high school and junior high school social studies teachers. He found that few of the teachers in his study indicated awareness of brain-based concepts. However, he found that two-thirds of those who were aware of any of the ten brain-based concepts identified in his study felt that the concepts lent themselves to techniques and activities that were applicable to their teaching situation. Frank recommended inclusion of brain-based principles in teacher education.

Calella (1994) compared 100 elementary school teachers' knowledge of brain-based principles with their teacher training.. Calella pointed out that for most of this century teacher education was based on behaviorist principles. She added that until recently a suitable, resulting in teacher education programs that did not have a suitable theory for the practice of educations, and that teachers trained "without a solid theory of learning function as technicians who learn to implement a series of procedures. These technicians are 'teachers with a bag of tricks'" (Reitz and Kehr, 1990, p. 366, qtd in

Calella, 1994, p. 15). Calella observed that when teachers perform as technicians without being grounded in a theory, function well until they come into contact with students who do not respond to the technique they are currently using. Calella also noted that "teachers, as well as students, learn by assimilating new information into their individual patterns of knowledge" (p. 54).

Calella (1994) discovered that teachers obtained knowledge about brain-based principles from attending conferences and obtaining specialized certifications. She also observed 28 randomly selected teachers to determine if knowledge of brain-based principles transferred to classroom teaching, and she found that teachers knowledgeable in brain-based principles demonstrated observable behaviors consistent with brain-based principles

Raffin's (1996) qualitative study of eight public school teachers and three administrators found that brain-compatible learning and instruction educated the whole child, helped students connect school to real life, prepared students for life in a democratic society, and caused the teacher's role to change to that of facilitator.

Parisian (1997) investigated the effect of using a natural intelligence model of instruction with ninth grade students. His natural intelligence model including Lozonov's method of Suggestopedia, nuerolinguestic programming, and congive elements including imagery, visual icons, chunking, mind-mapping, and mnemonics. Parisian says that his model encourages active and self-directed learning of students. Of teachers, it requires a paradigm shift from role of dispenser of information to a role of facilitator.

Smith (1999) compared three elementary school teachers who had completed training in a 5-day brain-based workshop with three teachers who had no training in

brain-based principles using random interviews and observations. She observed no difference between teachers trained in brain-based instruction and those not in the following behaviors: creating absence of threat in the environment, varying learning and teaching styles, and meeting student individual needs. However, she did observe that those trained in brain-based instruction surpassed those not trained in brain-based instruction in social interaction, behavior, and preparedness of students. She also found that the trained teachers had significantly different classroom environments than the untrained teachers in classroom arrangements, absence of sarcasm and negative feedback, attentiveness of students. She recommends further research in the use of brain-based principles from birth to graduate school to identify which brain-based approaches will provide the most effective instruction.

Karlen (1999) studied 10th, 11th, and 12th graders enrolled in a learning to learn course to discover how they processed their most meaningful experiences. She found that an encouraging community and a classroom that exposed students to relevant learning experiences contributed to personal transformation. Karlen concluded that to create an environment conducive to student transformation, teachers needed to redefine their role as not only teaching the subject, but also communicating universally shared values.

Summary

Adult learning theory and composition theory share the philosophical transition from behaviorist to constructivist orientations. Both experience tension between process and product and the degree to which students should direct their own learning as opposed to be held to standardized curriculum. Both embrace aspects of the behaviorist, cognitive, constructivist, humanist, and social orientations as discussed in this chapter.

According to the research, learners should be self-directed, reflective, strategic thinkers, constructivists, motivated, and success-oriented. However, as shown by this study and others, developmental students do not exhibit theses characteristics (Boylan, 2002; Grow, 1991; McCabe, 2000; Roueche & Roueche, 1999). Therefore, part of the developmental educator's task becomes meeting students at their levels and helping them develop not only skills for college, but also an efficacy toward learning and an awareness of their own learning process (Maxwell, 1997).

Teaching strategies designed to strengthen students' metacognitive skill are found in the brain-based principles as well as in adult learning theory and composition theory, including collaborative learning, active learning, self-directed learning, metacognitive strategies, reflection, learning styles, multiple intelligences, among others.

Also, the dichotomy between learning and learner centered approaches appears in adult education, composition theory, and developmental education. Brain-based principles definitely align with the learner-centered approach, which can be traced to experiential learning in the constructivist orientation. In 1970, Gleazer said that colleges would have to actively make changes to meet the needs of underprepared students:

> I am increasingly impatient with people who ask whether a student is "college material." We are not building a college with a student. The question we ought to ask is whether the college is ... student material. It is the student we are building, and it is the function of the college to facilitate that process. We hav him as he is, rather than as we wish he were....Can we come up with the professional attitudes [necessary to] put us in the business of tapping pools of human talent not yet touched?...The greatest challenge facing the community college is to make good on the promise of the open door. (p. 51)

In response to the statement that brain-based learning is nothing more than practices and strategies that have over time become recognized as good teaching (Bruer,

1998), Caine and Caine (1997), and Sylwester (2000) respond that even though many strategies are the same, brain-based learning not just a collection of strategies, but a new paradigm. They say that the present paradigm is highly mechanistic with the world viewed as a machine, with the option of adjusting the parts to produce the desired result. However, both identify a new paradigm of constant change with unexpected results from interventions.

Caine and Caine (1997) describe three approaches to instruction, one in the traditional mechanistic style, one moving towards a brain-based instruction, and one that fits brain-based approach. The traditional approach and brain-based approach are contrasted in Table 2.

In the first approach, the present paradigm, instruction focuses on acquisition of specific facts and skills in a prescribed time period. Curriculum is selected by the teacher and includes textbooks lectures, videos, and designated subjects, and assessment relies on students' replication of what has been presented to students. The second approach is more complex. Rather than using standardized curriculum, faculty create experiences that expand from facts and skills to ideas and concepts. Time is more flexible, with students needing greater amounts of time for projects. Instruction includes group work, discovery, technology, thematic instruction, and integrated curriculum, still structured and under faculty control.

The third approach in which teaching is described as "fluid and open" (Caine & Caine, 1997, p. 219). The curriculum consists of "dynamical and expansive knowledge" that relates to everyday life (p. 219). The instructor's time is connected to learner as they

Table 2

Traditional vs. Brain-Based Instruction

Aspect of Instruction	Traditional Approach	Brain-Based Approach
Objectives of Instruction	Acquisition of pre-specified, correct information, facts, and skills	Expansion of dynamical and expansive knowledge that applies to everyday life
Sources of Curriculum	Teacher-selected texts and Authoritative sources, lectures videos	Multiple, including texts and peer teaching, thematic instruction, student-centered topics and interests
Instruction	Teacher as authority	Teacher as facilitator
Assessment	Students replicate what has been presented	Authentic assessment of all types, including self-evaluation, process, product

Adapted from Caine & Caine (1997)

develop their complex and learner developed projects. Curriculum is an integration of prescribed curriculum with available resources that fulfill needs as students develop learning projects based on their own interests. Assessment is authentic with evaluation of both process and product, including student self-evaluation.

Caine and Caine (1997) acknowledge that the traditional school system organization makes it difficult to educate students in such an unstructured environment. Orientation three sounds a lot like situated cognition (Brown, Collins, & Duguid, 1989; Wilson, 1993) and experiential learning (Dewey, 1897).

Additionally, brain-based learning theory relates physiological changes with learning (Cardoso & Sabbatini, 2002; Diamond & Hopson, 1999; Kemperman & Gage, 1999; Merzenich, 2000; Sapolsky, 1996). Teaching strategies developed from this knowledge base are similar with those developed through observation of behavior and

trial and error. It remains to be seen if and how the physiological aspects of learning will contribute to approaches to learning with developmental students.

This study will provide two English 060 faculty, our three classes, and myself the opportunity to develop and deliver lessons according to brain-based principles and reflect on the effect. We hope to compare the brain-based learning lesson(s) to the more familiar adult learning theory and composition theory and discover if brain-based learning theory offers additional instructional benefits.

CHAPTER 3: RESEARCH METHODS

This case study examines the presumed effect of intentionally incorporating a teaching approach using principles of brain-based principles in three developmental English classes at Pikes Peak Community College. Three instructors, including the researcher, developed and presented at least one lesson using brain-based principles. The study will examine the effect of intentionally incorporating brain-based elements in the English 060 classes through faculty and student interviews, faculty journals, and student improvement in pre and post semester scores in a writing sample and two-part attitude toward writing survey. This chapter will provide information about the research design, site and participants, data collection procedures, measures, data analysis procedures, and discussion of trustworthiness of data.

Research Design

This study uses a mixed-method design in that both qualitative and quantitative data are collected. The qualitative and quantitative data were collected simultaneously and complementary to each other, with the qualitative case study being the dominant method (Tashakkori & Teddlie, 1998). Table 3 illustrates a timeline for the collection of quantitative and qualitative data and the delivery of the lesson(s) developed with brain-base principles.

The Case

The primary approach is a descriptive case study of three instructors' and up to nine students' responses (through interviews and instructor journals) to the incorporation of brain-based principles in an English 060 class, and in the case of the instructors, to the design of lessons using those principles.

Table 3

Timeline for Data Collection And Delivery of Brain-Based Lesson

Data Collection	Week of Semester														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Instructors design brain-based lesson(s)	xxxxxxxxxxxxxx														
Instructors teach brain-based lesson(s)					xxxxxxxxxx										
Quantatitative - Pre/Post Test															
Student Writing Sample	x											xxxxxxxxxxxxx			
Student Attitude toward Writing	xxx											xxxxxxxxxxxxx			
Qualitative															
Faculty Interviews (3)	xxxxx								xxxxxxxxx					xxxxxx	
Student Interviews (3)		xxxxx							xxxxxxxxx					xxxxxx	
Faculty Write Journals										xxxxxxxxxxxxxxxxxxxxxxx					

The case for this study is three English 060 classes taught on the Centennial Campus of Pikes Peak Community College in the fall semester of 2001 for which instructors developed and presented lessons based on brain-based principles. A single case which focuses on a phenomenon (which in this study is the effect of incorporating brain-based elements in the curriculum of three English 060 classes) may have subunits embedded within it (Merriam 1991, Miles & Hubermann, 1994; Yin, 1989). This single case has embedded within it the three individual classes, each with an instructor and students. Therefore, this study utilizes an embedded, single case design (Merriam, 1991; Miles & Hubermann, 1994; Yin, 1989).

Rationale for Qualitative Approach

Qualitative case study research "is an ideal design for understanding and interpreting observations of educational phenomena" (Merriam, 1991, p. 2). Through the qualitative model of inquiry, researchers attempt to construct meaning and understand concepts and/or theories in their natural settings. Qualitative researchers give up the control of the quantitative experimental design in order to explore a situation to discover what is going on through description, interpretation, and analysis. According to Merriam (1998), the emphasis of "discovery, insight, and understanding from the perspectives of those being studied" (p. 1) in qualitative research lends itself to developing insights into the practice of education.

Salient characteristics of qualitative research relevant to this study include (1) awareness that reality is subjective and multiple as seen by participants (Creswell, 1994); (2) focus on the nature or essence of a phenomenon (Merriam, 1998); (3) the goal of understanding, description, discovery, meaning, the generation of a hypothesis (as opposed to the testing of a hypothesis) (Merriam, 1998); (4) use of small, nonrandom, purposeful samples (Merriam, 1998); (5) researcher as the primary instrument of data collection through interviews, observation, and documents (Merriam, 1998); (6) inductive analysis (Merriam, 1998); (7) comprehensive, holistic, expansive, and richly descriptive findings (Merriam, 1998); and (8) provision of contextual information (Merriam, 1998).

Rationale for Quantitative Approach

The less dominant approach uses quantitative data collected by the developmental studies English department from all English 060 classes on Centennial Campus in the fall semester of 2001. The institution and developmental English department agreed to share

anonymous pre and post semester scores from an institutional study on semester improvement of English 060 students on a writing sample and a two-part survey on student attitude toward writing. With the permission of the institution and the developmental studies English department, improvement scores for the classes participating in this case study will be compared with anonymous improvement scores of the classes not participating in the study. Additionally, the survey responses of students interviewed in the study can be compared to their interview transcripts for reliability of their responses.

This addition of quantitative data will add depth and perspective to the study by (1) allowing for confirmation between research styles (triangulation) (Greene et al, 1989); (2) permitting emergence of different facets of the application of brain-based teaching (Greene et al, 1989); and (4) adding scope and breadth to the study (Greene et al, 1989) by allowing comparison of improvement on a writing sample and attitude towards writing survey between the classes intentionally incorporating brain-based elements and the other English 060 classes.

Site and Participants

Site

Pikes Peak Community College (PPCC) is located in Colorado Springs, Colorado (population 500,000). Colorado Springs is located on the eastern slope of the Rocky Mountains on I-25 (the north south corridor of the state) 60 miles south of Denver and 45 miles north of Pueblo and serves El Paso and Teller counties. Three military bases are located in Colorado Springs: the Air Force Academy, Peterson Field, and Fort Carson Army Base.

Founded in 1969, Pikes Peak Community College serves El Paso and Teller Counties and is one of 13 community colleges in Colorado. In the fall semester of 2001, PPCC served 9,729 students, 15% of the 65,801 students served by state system colleges in vocational and certificate programs, high school programs, and academic programs (Kimberly Thompson, Colorado Community College System Office, personal communication, May 2, 2003). Data are taken from Colorado community College System Warehouse as of May 2, 2003). The college serves a significant number of students associated with the military as well as having close relations with business and technology in the community.

PPCC has three campuses in Colorado Springs. The Centennial Campus is the oldest campus, dating back to 1976, and is located in the southern part of Colorado Springs close to Fort Carson Army Base. The Rampart Range Campus is the newest campus, and it is located twenty miles north of Centennial Campus, close to the Air Force Academy. Midway between the two is the Downtown Studio Campus, serving the downtown area. Students attending Rampart Range Campus tend to represent a somewhat higher socio economic class and tend to be closer to high school age than those at the Centennial Campus and the Downtown Studio Campus. Centennial Campus has the highest enrollment of the three campuses, especially in developmental courses.

Centennial Campus was chosen for this study because (1) more English 060 classes offered on that campus in the Fall of 2001 than on the other campuses, increasing the pool of possible participants for the case, (2) the diversity of students and socio-economic backgrounds of the students is more likely to be representative of other

suburban community colleges in Colorado, and (3) it was convenient to have all three classes from the same campus.

Participants

Faculty participants. All faculty teaching English 060 on Centennial Campus during fall semester, 2001, were invited to participate in the study with a flier placed in their campus mailboxes the week before classes began (see Appendix C). If more than two faculty expressed interest in participating in the study, factors such as successful experience as documented on faculty evaluations, recommendation of the Dean of Developmental Education and the Developmental English chair, and the availability for interviews and other activities required for the study would be considered.

Three instructors responded to fliers describing the study. Two were fulltime instructors, one having taught Developmental English for six years and the other having taught Developmental English for ten years. The third was an adjunct instructor who had another fulltime position and came to teach at PPCC over her lunch hour and in the evening and who had been teaching Developmental English for two years. The full time instructors were chosen for the study because they had more experience, a recommendation from the dean, and because their schedules would make it easier to arrange interviews and other communications for the study. The two faculty participants each chose a code name for the study: Bosco and Rufus. I used my own name, Tina.

Bosco began her teaching career working part time with adult basic education students while earning her Masters Degree in English literature in the 1970s. After completing her degree, she accepted a full time position working with underprepared adult students in a community college in northern Colorado in the adult basic education

program and the developmental studies program. She later moved to New York City where she taught English in a developmental studies program for several years before coming to Pikes Peak Community College in 1991. She likes teaching basic writers because the students are really interesting and continue to challenge her presuppositions and views about teaching.

Rufus said he came to teach developmental English by accident. After serving in the military and earning a Bachelor's Degree, he took a position as a newspaper reporter, and as a reporter he enjoyed going to the community college for news articles. As a result, he decided to try working there, so he took a part time position in a tutoring center at El Paso Community College (in Texas). He liked working with the developmental students so much that he decided to go to college to return to school to earn a Masters Degree in rhetoric so he could obtain a full time position. Rufus joined the PPCC faculty in 1997. Rufus said he likes working with developmental students because he shares an identity with them because of his working class background.

I graduated from college in the 1960s with a Bachelor's Degree in psychology and a Masters Degree in education through the National Teacher's Corps. After teaching junior high English for four years in New Jersey, I moved to Colorado where I had the opportunity to work in a tutoring program at a community college for eight years before moving to Colorado Springs and eventually teaching in the developmental studies division at Pikes Peak Community College in 1988. I like working with developmental students because so many begin their college experience with eagerness and enthusiasm that education will make a positive difference in their lives.

In fall semester, 2001, Rufus taught just one English 060 class while Bosco and I each taught two English 060 classes. Bosco and I each chose one of our two classes for the brain-based instruction. I chose the class with more students for the study because a larger class would better withstand the high attrition rate often experienced in English 060 classes. Bosco chose the class for the study by the toss of a coin. Faculty participating in the study signed permission forms approved by the Colorado State University's human subjects committee for this study (See Appendix D). Faculty permission forms will be kept for three years in a locked file in the principle investigator's office.

Student participants. English 060 students attending Centennial Campus are representative of the academic level of developmental English students in English 060 across the state of Colorado since the community colleges of Colorado use the same placement criteria and the same curricula for all developmental studies courses.

There was no attempt to obtain a random sample. Student participants for the case study were chosen on the basis of their enrollment in a class taught by a participating faculty member. In order to avoid the possible effect of faculty bias, either positive or negative, toward students being interviewed for this study, the identity of students participating in interviews was not revealed to faculty.

Also, it was thought that students would be more open in their interview responses with a student interviewer as opposed to an instructor (who might have them for a class in the future) or an administrator (who could be viewed as an authority figure). Therefore, it was decided that a peer would interview students, and a tutor from the college's peer tutoring program was selected at the recommendation of the director of

that program. The student interviewer was chosen because he successfully tutored all levels of English, was well-liked by students, and because he was a conscientious student.

All students in the selected classes were given the opportunity to volunteer to participate in the study by being interviewed three times in the course of the semester. In each of the three classes, the peer tutor at PPCC explained the purpose the nature of the study, explained permission forms, and invited students to be interviewed three times over the semester. He visited each of the three classes during the first week of the semester, and the instructors left the room while the peer tutor distributed fliers describing the study (see Appendix C) and explained how a student could participate in the study as an interviewee. Students were given a small stipend for their participation in interviews.

The peer tutor was trained to select students to be interviewed on the basis of their apparent openness and perceived inclination to provide relatively detailed answers to interview questions (Kvale, 1996). However, when only eight students volunteered to be interviewed for the study, the peer tutor accepted all as interviewees. Five students completed all three interviews, one completed two of the three interviews, and two completed only the first interview. All interview information was used for coding student interviews.

Permission forms for pre and post semester scores on a writing sample and two attitude toward writing surveys to be used in a comparison to students not in the brain-based group were signed by all students in the three classes (Appendix D). The institution agreed to share with me the anonymous pre and posttest scores on writing samples and surveys for students in the remaining English 060 classes (See Appendix B). PPCC's

student interviewees participating in the study also signed permission forms approved by human subjects for this study (See Appendix D). Student permission forms will be kept for three years in a locked file in the principle investigator's office.

No attempt was made to control for or gather information on the specific demographics of the student participants. According to PPCC's institutional statistician (Baxter, personal communication, April 15, 2002), typically, in developmental English classes on Centennial Campus at PPCC, females outnumber males; additionally it is common to find a significant number of single mothers, students enlisted in the military, spouses of enlisted personnel, nonnative speakers of English, students with learning disabilities and/or physical disabilities, and students employed half to full time. According to Baxter (personal communication, April 15, 2002), the students taking English 060 at Centennial Campus in fall, 2001, demonstrated a diversity of age (from sixteen to over fifty), ethnicity, and educational background (high school graduate, GED recipient, and high school dropout).

Intervention

The intervention was the inclusion of a lesson using brain-based principles in each of the three classes. To help instructors understand the principles of the brain-based approach, I gave them each printed information on brain-based principles taken from Caine and Caine (1997). Also, I met with them individually to discuss the principles and to brainstorm possible brain-based lessons for areas they identified as wanting to explore with their classes in a new way. In the course of our interviews, I pointed out brain-based principles that related to their identification of successful and unsuccessful strategies for developmental students. I identified four lessons that I counted as brain-based for this

study, and the other two each created one brain-based lesson. We agreed to try to visit each other's classes during the semester, and although our intentions were sincere, we never managed to schedule the visits.

Quantitative Data

The quantitative data was obtained from an institutional study conducted by the developmental studies English department to attempt to measure student improvement over the semester using a pre and post semester timed impromptu writing sample and a pre and post semester two-part attitude toward writing survey. For this study, student semester improvement on the quantitative measures for the classes in which lesson(s) using brain-based principles were intentionally incorporated were compared with improvement scores for the remaining English 060 classes. This section will discuss the quantitative data collection, quantitative measures, quantitative data analysis for the institutional study and for this study, including reliability, validity, and integrity of the intervention.

Quantitative Data Collection

Quantitative data was obtained from an institutional study conducted in the fall semester, 2001, by the developmental studies English department. Prior to that study, the developmental studies English department conducted a pilot in the spring of 2001 with three English 060 classes on Centennial Campus. The purpose of the pilot was to evaluate the data collection procedure and try out the measurements. As a result of the pilot, the data collection procedure was established and the parameters for the inclass writing samples were refined and limited to a single paragraph.

The week before classes began in the fall of 2001, faculty teaching English 060 on Centennial Campus received fliers describing the study, the instruments, and the pre- and post-testing procedures. Four full time English 060 instructors met two weeks before classes began and decided upon a prompt that would be used for the beginning of the semester writing sample and a different writing prompt that would be used for the post semester writing sample. The prompt for the beginning of the semester writing sample was announced, as it always is, in a memo welcoming faculty to the semester and providing logistical information about the class and the semester. Faculty received that memo the week before classes started.

Writing samples for the institutional study were collected from students the first day of class and at a time of their individual choosing during the last four weeks of class. All classes used the same prompts for the writing samples and the same requirements for the inclass writing (one paragraph with topic sentence developed by primary and secondary support). The timed impromptu writing samples were completed during class time. Students who were absent the first day of class or on the day of the post-semester writing sample were requested to complete the writing sample in either the Writing Center or the math lab. Students' writing samples were handwritten; no word processors were used.

The surveys were completed during the first two weeks of the semester and during the last four weeks of the semester. Instructors chose whether to allow students to take surveys home or require that they be completed in class.

Student confidentiality was protected with the use of code names. Students chose a code name to be used on their writing samples and surveys. During the first week of

class when they wrote their inclass writing samples, they were given an envelope and an index card. They were instructed to write the code name they wanted to use for the study on the index card, place it in the envelope, seal the envelope, and write their real names on the outside of the envelope. The envelopes were collected by the instructors, given to the developmental studies English department chair, and filed by class until the end of the semester, at which point they were returned to faculty in a packet of materials to be used for the post-testing. When it was time for the students to complete the end-of the-semester writing samples and surveys, instructors gave the students the envelopes with their names on the outside and code names sealed inside to help them remember their code names.

Test data was stored in a portable file that was kept in the developmental studies English department chair's office. Each class's information was stored in its own hanging file folder, and each hanging file folder contained three separate, color-coded file folders: one for pretests, permission forms, and envelopes containing code names; another post-tests; and the third for data from students who did not finish the semester. Each writing sample was copied twice for distribution to those who would read them and assign a score. Originals were placed in the appropriate class file; duplicates were kept in a separate file and grouped by class.

The eighth week of the semester, packets for the post-tests were prepared for distribution to instructors. An administrative assistant assembled the packets for each class. First she obtained a current list of students enrolled in each class. If a student was no longer enrolled in the class, the administrative assistant opened that student's envelope containing the code name so that she could remove that student's pre tests. The pre tests

along with the envelope and index card containing the code name were stapled together and placed in a folder for students who did not complete the semester. Next, directions for the post-semester writing sample and an adequate number of surveys were placed in a large envelope for each class and distributed to faculty the ninth week of the semester, two weeks before the post-testing was scheduled to begin.

Characteristic of developmental students are lack of motivation and confidence, poor attendance, external locus of control resulting in diminished self-directedness, and a low completion rate (Grow, 1991; McCabe, 2000; McCabe & Day, 1998; Maxwell, 1997; Roueche & Roueche, 1993 & 1999). This group was expected to be no exception, and as a result, it was anticipated that a significant number of students would not complete both the pre and posttests in all measurements. All completed pre and post test information was used, so that if a student completed both pre and posttests for the attitude-toward-writing survey, but only a pretest writing sample, the survey information was included in the data analysis, but not the writing sample. In order to obtain as many scores as possible, the department arranged for students to complete the writing sample in the Writing Center or math lab if they did not complete them with their class.

Quantitative Measures

Writing samples. For the institutional study, all English 060 classes on Centennial Campus completed a writing sample using the same prompt the first week of class. Then within the last four weeks of the semester, all classes wrote a second inclass writing sample using a second prompt that was chosen at the beginning of the semester.

Although the use of timed, impromptu, inclass writing samples consisting of a single essay has been criticized as unreliable (Gao & Colton, 1997; Hayes, Hatch, & Silk,

2000; Welch & Martinovich-Barhite, 1997; "Writing Assessment," 1995) and not representative of real-life writing situations (Swanson, Norman, & Linn, 1995; Wiggins, 1993), it has also been argued that using them is both possible and desirable to teach students to adapt the principles of the writing process (Frick & Fulton, 1991; Wolcott, 1987).

The developmental English department chose to include a timed, impromptu, inclass writing sample to measure pre and post student performance because it already requires that students complete a writing sample at the beginning of the semester to double check student placement, and the department wanted to determine if students would score higher at the end of the semester. The writing concepts taught in English 060 include development of a paragraph with topic sentence, development of ideas with primary and secondary support, avoidance of major sentence errors, and a thoughtful response to the prompt. Student improvement in these elements of writing would be observable and measurable in a short writing, so it was thought the use of the writing samples was appropriate for the purposes of the department study.

English 060 instructors took steps to minimize stress students might feel regarding the writing samples. The first day of class, students were told that the writing sample would not count for their grade, but would be used to check their placement into English 060. This is actually the case, and the inclass writing sample is given the first day of class every semester. Also, it was believed that the semester's instruction on paragraph development and sentence structure would increase student confidence so that the post semester inclass writing sample would not be threatening. Additionally, over the course of the semester, students had opportunities to write during class time and receive

feedback on their work so that they would be more comfortable with inclass writings. Since the prompts required only general knowledge, students could use information from their own knowledge base and experience to develop their writings. The initial writing sample prompt asked students to select a controversial issue and take a stand. The concluding writing sample prompt asked students to describe the qualities of a successful student.

At the beginning of the semester, a student is likely to take a writing sample seriously, but towards the end of the semester, some students find themselves taking their class work lightly. Instructors were asked to encourage students to do their best on the post-class writing sample, which could include giving them points towards their class grade.

While the writing prompts and time allotted were the same for all classes, some differences could have accounted for variation in improvement according to class. Although the initial writing sample was universally administered on the first day of classes, faculty could administer the second inclass paragraph any time during the last four weeks, so that some classes received a little more than three weeks of additional instruction before completing the post semester writing sample. Also, instructors varied in the number of times their students practiced inclass writings during the semester, giving classes with more practice in writing inclass paragraphs an advantage over classes with less practice. No controls were imposed or adjustments made in scoring based on time of final writing sample or amount of practice with inclass writing.

Attitude toward writing surveys. For the institutional study, students were given two surveys, a two-part attitude toward writing survey and a survey of awareness of the

writing process. For this dissertation study, data was requested only from the two-part attitude-towards-writing survey (see Appendix E).

The instrument to assess student attitude toward writing was developed by Palmquist and Young (as reported in Charney, Newman, & Palmquist, 1995). For the survey, students responded on a Likert scale from 1 (Strongly Disagree) to 5 (Strongly Agree) to 12 statements related to their perception of their ability to learn to write, their enjoyment of writing, and their self-assessment of their writing ability (see Appendix E). Charney, Newman, & Palmquist (1995) reported that the three subscales of their survey were reliable (learnability, Cronbach's alpha of .68; enjoyment/writing apprehension, a of .82; and self-assessment of writing ability, a of .77).

For the institutional study, the department developed its own survey asking students to describe their comfort in aspects of the writing process such as coming up with ideas, organizing, editing for spelling, and so on. The second part of the attitude-toward-writing survey consisted of nine elements that students rated on a four-point scale from "very hard" (1) to "very easy" (4). This survey had not been previously tested for validity or reliability, although it has face validity (Zeller, 1997) in that its statements were derived from the important elements of the course. It was anticipated that student improvement scores in this instrument could be greater than gains in the Writing Sample scores as a change in student attitude toward writing is a first step toward improvement in writing (Stan and Collins, 1998).

Quantitative Data Analysis for Institutional Study

Writing samples. The writing samples were scored on a 20-point rubric with weighted scores for purpose, development of ideas, style, and mechanics. The department

hired three adjunct instructors to grade the writing samples. The readers all had taught English 060 for more than three years and received positive evaluations from students and the developmental studies English chair. The readers participated in a two-hour norming session to establish inter-rater reliability. The readers were given four writing samples to grade before coming to the norming session. The readers compared scores and then discussed each writing sample until all graders came to agreement within two points. The department chair audiotaped the session.

Pre and post semester writing samples were distributed to graders with each writing sample being read by two graders and each grader reading the same students' pre- and posttests. Beginning-of-the-semester writing samples were distributed immediately after the training session, the 6th week of the semester. End-of-the-semester writing samples were distributed as classes turned them in, with the final writing samples distributed by the last day of classes. Readers were given a grid on which to record their scores for each writing sample. Appendix F contains the scoring rubric for the Writing Sample. For analysis, each student's score was calculated by totaling the scores of the two readers, resulting in a possible 40.

Attitude surveys. The two parts of the attitude toward writing surveys were scored separately. The first part consisted of twelve statements to which students responded on a 5-point Likert scale, with 5 points assigned to the highest value and 1 point assigned to the lowest value. Three statements were written in negative terms and given reverse scoring. The highest score possible was 60. The comfort with the writing situation section consisted of nine statements rated on a scale of one to four, with four being highest. The highest possible score was 36. An SPSS (version 8) t-test was used to determine

significance of improvement over time from pre to post test. Appendix E contains a copy of the Attitude Toward Writing Surveys.

Quantitative Data Analysis

For this study, the scores from the three classes intentionally including brain-based lesson(s) in their instruction were compared to the four English 060 classes that did not intentionally include non-brain-based lessons in their instruction with an SPSS (version 10) t test. Cronbach's Alpha, using SPSS 10, would also be used to obtain correlation scores for the three measures and to obtain inter-rater reliability of the readers for the writing samples.

The quantitative data was also used for triangulation to compare reports of the improvement of the students who were interviewed with their actual improvement on the writing sample and their responses on the surveys (See Appendix I).

Integrity of the Intervention

While the inclusion of quantitative data will add the dimension of change over time in student performance, it is unlikely that the gain scores in the writing samples and attitude toward writing surveys of students in the brain-based classes will differ significantly from the gain scores of writing samples and attitude toward writing surveys of the students in the non-brain-based classes in the study for several reasons.

One reason not to expect significant differences in gain scores between the group participating in this case study and other English 060 classes is that there was no way to control instruction in other classes. It is entirely possible that any instructor could use methods of instruction that would be considered brain-based. Therefore, it is not

reasonable to believe that the three classes in this study could form an experimental group with the remaining classes taught on the same campus forming a control group.

Also, Bosco and I both taught two English 060 classes and selected one for the inclusion of brain-based elements. While providing the advantage of controlling for instructor difference, there was a possibility of our unintentionally including brain-based principles in the class designated as not incorporating brain-based elements. The study actually was contaminated because Bosco delivered her brain-based lesson to both of her English 060 classes, not just the one she selected for the study. Also, I included some brain-based principles in my non-brain-based class as well, even though it was much less than in the brain-based class.

Additionally, instructors had several weeks in which to choose to administer the posttests. Therefore, students taking posttests later during that time frame could be expected to have an advantage over students taking the posttests at an earlier time. Also, there was no control over how instructors prepared students to take the posttests, and some instructors may have been more directive in preparing for the writing sample than others, which would be an important factor in student performance not related to the inclusion of brain-based instruction.

Another reason not to expect significant differences in gain scores between the group participating in the study and other English 060 classes is that the instructors participating in this study each only designed one brain-based lesson, which would not in itself present a significant impact over the course of a fifteen-week semester.

Other researchers have found that the intervention of teaching techniques using brain-based principles resulted in improvement in attitude and orientation to learning, but

not in actual writing sample score or grade improvement. (Fabien, 1984; Rini, 1990). It was hypothesized that grade improvement would follow the improvement of orientation to learning (Fabien, 1984; Rini, 1990). Also, at least one study found no significant difference in motivation between two community college history classes, one taught with a traditional method and the other taught with a constructivist method (Quick, 2000). In a classroom situation, variables beyond the control of the research often affect results.

While the quantitative measures may not result in significant differences in student performance, the inclusion of improvement scores in the Writing Sample and attitude toward writing surveys provides a check on the qualitative data from students being interviewed. For example, if students reported in their interviews that they felt their writing improved and that they felt more confident in their writing, this could be verified with the actual pre/post writing sample scores and their survey responses related to confidence in their writing. Also, the quantitative data could show similarities between the two groups in beginning and end of the semester writing sample and attitude toward writing survey scores.

Qualitative Data

The rich, thick description of student and faculty response to brain-based instruction resulted from analysis of transcriptions of audiotaped interviews with faculty and students and through faculty journals. Students and faculty participating in interviews gave their permission that their data be used anonymously for this study (See Appendix D). The purpose of the study was explained in a letter that included a statement that participants could at any time withdraw from the study with no negative effects.

Qualitative Data Measurement and Collection

Student interviews. To avoid the possibility that students would be less than open if interviewed by an authority figure such as an instructor, the decision was made to have a student interview the students in this study. A student in the peer tutoring program was selected on the recommendation of the peer tutoring director. The student interviewer was trained by reading with the questions and in the purpose and scope of this study before actually interviewing students. Also, in anticipation of the study, the student interviewer was provided text on interviewing techniques from Kvale (1996) and practiced interviewing four students in the summer of 2001. He practiced probing, specifying, direct, indirect, structuring, and interpreting questions as well as the use of pauses to give interviewees opportunity to reflect on their answers (Kvale, 1996).

The student interviewer was instructed to use the same questions for each student as a starting point and to feel free to ask additional probing questions when he felt that it would help in the information gathering. At the beginning of each interview, he informed students that they could terminate the interview at any time, and he told them the circumstances under which he would terminate the interview (if the student became visibly upset). At the conclusion of each interview, he asked if the student wanted any part of the interview excluded from the transcript and would make a note for the transcriber if the student identified anything to be withheld.

The student interviewer set all appointments with the students. For students being interviewed, the time required outside of class was anticipated to be approximately ten to twenty minutes for each of the three interviews. Students would be interviewed on

campus in a study room in the library when possible. The interviewer had the option of taking the students to my faculty office for the interviews.

The student interviewer scheduled three interviews with the students over the semester: one at the beginning of the semester, one after the brain-based lesson was delivered, and one during the last two weeks of the semester. In all interviews, the interviewer asked students what teaching strategies they found most helpful for their learning and what strategies they found not helpful. In the second and third interviews, students were asked to identify any specific lessons that went well or did not go well over the semester. In order to discover if students on their own would identify the brain-based lessons as particularly beneficial, students were not aware that their instructors had incorporated the brain-based lessons in their classes. Students were only told that the study involved a teaching method.

Student interviewees used the same code name as they did for the writing samples and surveys. Original interview tapes were stored either in my office or with the transcriber until they were destroyed after being transcribed. The transcriber was also a student from the college's peer tutoring program. She was selected to transcribe all interviews as she had worked as a court recorder before deciding to attend Pikes Peak Community College. Student interview questions are listed in Appendix G.

Faculty interviews and journals. The two instructors participating in the study had a bigger time commitment than students, which was made clear before they agreed to participate in the study. I would interview the two participating instructors three times over the semester. It was anticipated that instructors would take from two to four hours developing their brain-based lesson; it would be difficult to determine the amount of time

they actually spent if the time thinking about the lesson as well as actually working on the lesson were included. Each instructor also would spend time writing a reflective journal after the brain-based lesson and review my coding of their interviews. The total amount of time spent on the study could be estimated to be up to twelve hours for the instructors. Interviews with faculty would be taped by me and then transcribed and coded. I responded to the interview questions in writing and coded my responses in the same way.

The first interview would focus on the faculty member's description of developmental students, identification of their instructional needs, identification of strategies that work well and don't work well, and identification of a prospective area of instruction that could be a candidate for the brain-based lesson. Interviews would also serve to impart information about brain-based learning with my taking the opportunity to point out connections of each instructor's teaching strategies to the brain-based principles. The second interview was to occur within one week of the delivery of the brain-based lesson and would focus on a description of the lesson and an assessment of how well it went. The third interview would occur the week after classes ended. Faculty would be asked to describe how the class went as a whole and how well they thought the brain-based lesson went in general. Since I was a faculty participant in the study, I answered the same questions at the same time as the other faculty members.

The interviews were conducted either in my office or in the other faculty member's office. At the beginning of the semester, the instructors were given a copy of the questions that would be asked at each interview, and before the second and third interviews, they were given a copy of the questions for those interviews as a reminder. We all agreed that we could visit each other's classes, but in the course of the semester

we never found time to follow through by actually making such visits. Additionally, I kept a journal of my impressions of the study, and I requested that instructors reflect in writing on the brain-based lesson after teaching it. Faculty interview questions are listed in Appendix G.

Qualitative Data Analysis

The interviews and journals would provide direct answers to questions 2, 3, 4, and 5 respectively. Interviews and journals would also be coded for emergent themes for question six (When faculty and students discuss successful and unsuccessful learning experiences in English 060 classes, what themes emerge, and how do those themes relate to brain-based learning concepts and strategies?). The transcripts were not coded until all interviews were completed and transcribed. The sentence became the unit of measurement.

Codes were assigned to any statements relating to successful learning experiences and barriers to learning. Coding the interviews and journals began at the end of the semester. I decided to manually code the data in order to feel closer to the material. A colleague experienced in open coding agreed to work on the coding with me.

Coding was open, meaning that each paragraph was evaluated for statements related to the topic of student success or nonsuccess and then assigned a category. Elements in the categories were numbered (Merriam, 1991; Miles & Hubermann, 1994; Yin, 1984). A master list of elements in the categories was maintained as the coding progressed. The category, number, and name of the element was written in the margin next to the paragraph in which it occurred, perhaps shortened to something like "SS#6 –

homework." Any time that concept occurred in the transcripts, the same notation was made in the margin.

A master list of the categories and elements was generated with the paragraph number(s) in which it was located so that it would be possible to return to the transcript to find the source for each element and to easily see how many times students and faculty referenced them. The coded elements were then divided into subcategories.

The data from interviews and journals was kept in two notebooks. The first notebook contained original transcripts with coding in the margin and was organized by the person interviewed. The second notebook contained three sections of condensed data. First, it contained a master list of codes according to categories and into subcategories. Second, it contained a log of the emergent categories and labels. Each category had a cover sheet that listed the elements in three sections: those only mentioned by faculty, those only mentioned by students, and those mentioned by both faculty and students. In columns next to each was the number of references to that element by instructor and total number of references by students.

Next came sequential listing of elements with references to locations in the transcript and to faculty (by name) or student (by class), organized by 1st, 2nd, or 3rd interview. The third section contained condensed transcripts organized sequentially with the speaker, the text, and the codes. Faculty participants were each given a summary of their transcripts with codes to check for reliability. Further explanation and description of the coding process and recording of codes is presented in Apendix H.

Six themes emerged from the coding: the learning process, student characteristics, instructor's characteristics, the outcome of the learning situation, and the writing process.

The themes were compared to the literature of brain-based learning and the theoretical orientations discussed in the literature review (the behaviorist orientation, cognitivist orientation, constructivist orientation, adult learning orientation, humanist orientation, and social orientation). The number of times each label was mentioned was counted, and more references to a label were interpreted as an indication of higher importance. Also, faculty and student views of learning were compared.

In each class, the first interview for both faculty and students occurred before delivery of the brain-based lessons and focus on the instructors' and students' identification of situations that facilitate learning facilitating and situations that pose barriers to learning; the second interview occurred after delivery of the brain-based lesson and focused on how the class is going and what has been working well from the faculty and student perspective; and the third interview occurred during the final four weeks of the semester and focused on an overall evaluation of what methods worked well or did not work well to facilitate learning over the semester. Instructor and student comments about learning were compared to brain-compatible learning theory.

While instructors commented directly on their thoughts about the brain-based lessons and brain-based concepts, as they understood them, students were not informed that the study evaluated specific lessons, and therefore commented on their overall impressions of the class and their learning. Any reference to the brain-based lessons from students was interpreted as evidence that those lessons had significance to the students.

Verification

This study used clarification of researcher bias, triangulation, member checks, and exploration of alternative explanations for verification of results (Creswell, 1998). In

Chapter 1, I established that I am biased towards brain-based theory. The study used triangulation by using quantitative and qualitative measures of student response to the brain-based instruction. Also, student interviews were compared to students' responses on the attitude toward writing surveys (Appendix I). The faculty participants were asked to review their interview texts and the summary information used for the study. Finally, when the results were obtained, various explanations for the results were explored.

CHAPTER 4: RESULTS OR FINDINGS

Introduction

The purpose of this study was to explore the effect of including lessons incorporating brain-based learning principles in English 060 classes at Pikes Peak Community College. Three Developmental Studies English instructors (including myself) designed at least one brain-based lesson for their English 060 classes in the fall of 2001. Quantitative data from an institutional study of English 060 classes were used to compare gain scores of those classes intentionally including brain-based elements into their classes with English 060 classes not intentionally including brain-based elements into the instruction.

The quantitative data included gain scores on a writing sample and a two-part attitude-toward-writing survey. Although no significant difference is expected in student gain scores based on the intentional inclusion of one or more lessons using brain-based principles alone, the quantitative data can be used to corroborate student interview data. Qualitative data for this study included interviews with the three instructors developing the brain-based lesson, six students in their classes, and instructor journals.

This chapter will be divided into three sections: first the quantitative results (including a description of the student population in the study and a comparison of the brain-based and non-brain-based groups), then the qualitative results, and finally the unexpected findings.

Quantitative Results or Findings

In order to determine if there would be a difference in semester improvement between the three brain-based classes and the four non-brain-based classes, this study compared improvement on a writing sample and two attitude-toward-writing surveys between the two groups. The quantitative data were taken from institutional research on improvement for English 060 classes at Centennial Campus during the Fall semester of 2001. This section will describe the students participating in that study and then answer research question 1 with a discussion of the data collected and analyzed from the improvement scores for the two groups.

Description of English 060 Students

Demographics and academic history. The two groups were within two percentage points of each other in gender, with the brain-based group consisting of 42% males and 58% females and the non-brain-based group consisting of 44% males and 56% females. The brain-based group had more white students (44%) than the non-brain-based group (37%). Otherwise, the groups had similar percentages of black, Hispanic, and other students. However, the groups differed in previous community college experience

Table 4

Demographics of English 060 Students Centennial Campus, Fall Semester 2001

	Gender		Ethnicity				Academic History	
	Male	Female	White	Black	Hispanic	Other	1st time Enrollee	Previously enrolled in CC
BB	26 (42%)	36 (58%)	27 (44%)	15 (24%)	11 (18%)	9 (14%)	30 (48%)	32 (52%)
Non BB	31 (44%)	39 (56%)	25 (37%)	18 (26%)	15 (21%)	11 (16%)	39 (56%)	31 (44%)
Total	57 (43%)	75 (57%)	53 (40%)	33 (25%)	26 (20%)	20 (15%)	69 (52%)	63 (48%)

BB = Brain-Based Group
Non BB = Non-Brain-Based Group
Source: PPCC Institutional Research, Dale Baxter, Institutional Researcher

with 56% of the non-brain-based group having enrolled previously in any courses in any community college and only 48% of the brain-based students having done so. See table 4 for the group composition in gender, ethnicity, and academic history.

Number and completion rate. The Brain-Based and Non-Brain-Based Groups were also similar in size and the number of students who began and completed the semester as shown in Table 5.

Pretest scores. PPCC students place into English 060 on the basis of their score on a computerized placement test (COMPASS). Their placement is checked the first day of class with an in class writing sample administered and graded by their instructors. Instructors can recommend students move up to English 090 or down to English 030 on the basis of the writing sample and supporting data such as reading level, previous academic experience, time required by out-of school-responsibilities, and other relevant factors. Therefore, it is reasonable to assume that all English 060 students are at the same level of writing proficiency.

A comparison of pretest scores for the three measures using a two-tailed t-test with SPSS 8 (Table 6) showed no significant difference in Writing Sample and Attitude

Table 5

Completion of Semester for Brain-Based and Non-Brain-Based Groups

	Began Semester	Finished Semester		Dropped Out	
		N	%	N	%
Brain-Based	68	41	60%	27	40%
Non-Brain-Based Group	70	43	61%	27	39%

Table 6

Mean Scores for Pretests

	Highest Score Possible	Brain-Based N	Brain-Based Mean	Brain-Based SD	Non-Brain-Based N	Non-Brain-Based Mean	Non-Brain-Based SD	Difference Between Means	t	Sig
Writing Sample	40	39	18.85	4.67	35	18.26	6.36	.59	-.46	.65
Attitude	60	42	36.33	8.52	40	38.50	6.23	-2.17	1.32	.19
Comfort	36	41	20.02	4.60	40	23.20	3.87	-3.18	3.36	.001*

* Significant to .01 level

toward writing scores, but the non-brain-based group's pretest on the Comfort with the Writing Situation survey was significantly higher.

Quantitative Data Analysis

This section of Chapter 4 will discuss the quantitative data analysis a description of the results, significance of results, and integrity of quantitative data.

Internal Consistency of Quantitative Measures: To determine reliability of the measurements in this study, Cronbach's Alpha was calculated for each of the three quantitative measures using an SPSS 10 program (Table 7). Only the Attitude towards Writing Survey proved reliable with a Cronbach's Alpha score of .81, which is above .7, which is considered the standard for reliability (Anderson, 1997; Morgan, 1997). The Writing Sample and Comfort with the Writing Situation are marginally reliable, while the Attitude toward Writing Survey is highly reliable. According to Anderson (1997), data

Table 7

Internal Consistency of Measurements

Measurement	N	Cronbach's Alpha
Writing Sample	75	.60
Attitude toward writing	82	.81
Comfort with writing situation	82	.61

Writing sample. The following discussion of the Writing Sample is provided for those who might replicate this study and whose replication might include reliable data. The use of a single sample of writing as a measure of student performance has been criticized because of inconsistency of individual performance (ETS Report, 1998; Gao & Colton, 1997) and because the impromptu writing situation can be stressful and therefore compromise performance (Frick, 1991; White, 1995). Additionally there is the concern inter-rater reliability of graders (ETS Report, 2000; "Writing Assessment," 1995).

Instructors in both the Brain-Based Group and the Non-Brain-Based Group attempted to minimize stress for the writing samples by (1) not counting the pretest writing sample as a class grade, (2) allowing discussion of prompt before writing, (3) practicing inclass writing over the semester, and (4) giving feedback to students over the semester that would prepare them for inclass writing assignments. Instructors varied most in the amount of discussion before writing and amount of practice devoted to inclass writings over the semester.

English 060 instructors chose a pretest writing sample prompt and a different posttest writing sample prompt, which all English 060 instructors would use for Fall

semester 2001. The prompts were intentionally broad enough so that English 060 students could develop a paragraph in a number of ways using personal knowledge. Also, although instructors varied in the amount and content of discussion of the prompt before the students began writing, each attempted to create the same conditions for both the pretest and the posttest.

Inter-rater reliability of writing sample. Each writing sample was graded by two of the three readers. The three readers attended a two-hour training for inter-rater reliability. At the end of the training, the readers had discussed four writing samples and concurred on a grade for each within two points on a twenty-point scale. The writing sample scores were calculated by adding the grades of the two readers together. The same two readers read each student's pre and posttest writing samples.

A count was made of readers' agreement in student improvement on the posttest. Eighty percent of the time readers agreed that a student improved or didn't improve, and twenty percent of the time one reader graded a post test higher than the pre test while the other reader graded the post test lower than the pretest.

To obtain a correlation between readers, an Alpha Correlation Coefficient was calculated using the SPSS 10 program. Since there were three readers, there were three combinations of two readers grading the same writing sample. A total of six Alpha Correlations were calculated using SPSS 10: each of the three combinations of readers was correlated twice, once for the pretest and once for the posttest. A correlation of .7 and higher is considered reliable (Anderson, 1997; Morgan, 1999). In only two of the six cases, one pretest combination and one posttest combination, did the Alpha Correlation (see Table 8) show a correlation less than .7, and in those cases the correlation was above

Table 8

Correlation for Writing Sample Readers

	Pretest Writing Samples		Posttest Writing Samples	
	N	Alpha Coefficient	N	Alpha Coefficient
Readers A & B	38	.84	38	.61
Readers A & C	30	.64	30	.82
Readers B & C	29	.75	29	.88

.6. In three of the cases, the correlation was above .8. Therefore, inter-rater reliability for the writing sample considered weak, but adequate.

With a weak Cronbach's Coefficient (.6, Table 7) for the Writing Sample scores and an adequate measure of inter-rater reliability of readers (Table 8), the writing sample would be considered a weak measure for this study.

Comparison of pre/post-test improvement for brain-based and non-brain-based groups. Results of improvement scores for the two groups are given in Table 9. The non-brain-based group achieved greater overall improvement in the writing sample while the brain-based group achieved a higher average improvement scores in the attitude toward writing and comfort with the writing situation surveys. However, those differences were not significant to the .05 level (See Table 11). Both groups were characterized with a large range of improvement.

Significance of Results

The number of students whose scores improved, declined, or remained the same for the three measurements was similar for both groups, with the non-brain-based group

Table 9

Descriptive Statistics for Quantitative Pre/Post-Test Improvement Scores

	N	Min	Max	Range	Mean	SD	# Test Questions
Writing Sample							
Brain-based Instruction	39	-5.5	18.0	23.5	4.41	5.33	40
Non-brain-based Instruction	35	-12.0	19.5	31.5	5.26	6.83	40
Total Group	74	-12.0	19.5	31.5	4.80	6.06	40
Attitude Toward Writing							
Brain-based Instruction	42	-11	14	25	2.43	5.869	60
Non-brain-based Instruction	40	-8	11	19	1.90	4.824	60
Total Group	82	-11	14	25	2.17	5.3583	60
Comfort with the Writing Process							
Brain-based Instruction	41	-9	13	22	3.33	5.32	36
Non-brain-based Instruction	40	-7	12	19	2.18	4.00	36
Total Group	82	-9	13	22	2.77	4.73	36

showing a higher percentage of students improving on the Writing Sample and the brain-based group showing a very slightly higher percentage of students improving on the surveys for Attitude and Comfort. See Table 10.

For this study it would be surprising if the Brain-Based group had significantly higher pre/pos-test improvement scores for the writing sample, attitude toward writing, and comfort with the writing situation surveys than the Non-Brain-Based group with the

Table 10

Number of Students Whose Scores Improved, Declined, or Remained the Same in the Brain-Based and Non-Brain-Based Groups

	Total	Improve		Decline		No Change	
	N	N	%	N	%	N	%
Writing Sample							
BB	39	28	71.7%	8	20.5%	3	7.8%
NBB	36	28	77.8%	7	19.4%	1	2.8%
Attitude Survey							
BB	42	27	64.3%	14	33.3%	1	2.4%
NBB	40	25	63.3%	13	33.0%	2	3.7%
Comfort Survey							
BB	41	29	70.7%	9	22.0%	3	7.3%
NBB	40	28	70.0%	9	22.5%	3	7.5%

intentional intervention of as few as one brain-based lesson. An Independent Samples Two-Tailed T-test for Equality of Means of the improvement scores proved this to be a correct assumption.

There was no significant difference in gain score between the brain-based and non-brain-based groups; however, in both the surveys (Attitude toward Writing and Comfort with the Writing Situation), the brain-based classes achieved a higher improvement score mean than did the non-brain-based classes, suggesting a trend in affective gain for the brain-based group, as seen in Table 11. However, it should be noted that only the Attitude Toward Writing survey showed strong reliability, so that it is not

Table 11

Statistical Analysis of Writing Sample and Survey Improvement Scores: Independent Samples Two-Tailed t-test for Equality of Means

	Pre/Post Test Improvement							
	Brain-Based		Non-BB					
	M	SD	M	SD	Difference	t	DF	Sig
Writing Sample	4.41	5.33	5.26	6.83	-.85	.59	72	.552
Attitude	2.43	5.87	1.90	4.82	.53	-.44	80	.658
Comfort	3.33	5.32	2.18	4.00	1.15	-1.06	79	.293

known if there would have been a significant difference in the Writing Samples and the Comfort with Writing Situation if the measures had been reliable.

Both the brain-based and non-brain based groups made significant improvement from pre to post scores on all instruments, and in the case of the Attitude and Comfort Surveys, the Brain-Based group had a higher t-score on every measurement (See Table 12).

Table 12

Pre/Posttest Results for All Measurements for Brain-Based and Non-Brain-Based Groups

		Pre-test		Post-test		Mean		
	N	Mean	SD	Mean	SD	Dif.	t	Sig
Writing Sample								
Brain-Based	39	18.85	4.7	23.26	5.5	4.41	5.2	.00
Non-BB	35	18.26	6.4	23.51	5.5	5.26	4.6	.00
Attitude Survey								
Brain-Based	42	36.33	8.5	38.76	6.3	2.43	2.7	.01
Non-BB	40	38.50	6.2	40.40	6.0	1.90	2.5	.02
Comfort Survey								
Brain-Based	42	20.14	4.6	23.48	5.0	5.24	4.06	.00
Non-BB	40	23.20	3.9	25.38	3.4	2.18	3.44	.00

Elements contaminating and weakening quantitative results. In addition to the weakness of the measurements, the study is weakened by the inability to control for the intervention of including brain-based principles into instruction for only the experimental group. First, the study was contaminated when one of the instructors presented her brain-based lesson to both the class in the control group and the class in the experimental group. Also, since brain-based instruction involves many of the activities commonly used in English 060 (collaboration, active learning, and metacognitive strategies, to name a few), it would be very possible that an English 060 instructor not in the brain-based group would incorporate lessons using brain-based principles in the class. Furthermore, the incorporation of only one brain-based lesson over a fifteen-week semester might not have a significant impact. Lack of significant improvement over a control group with the intervention of a teaching method has been documented in the work of Fabien (1984), Quick (2000), and Rini (1990).

At the same time, the fact that instructors in the brain-based group devoted time and attention to incorporating brain-based lessons might have resulted in a greater impact than that of instructors relying traditional and familiar methods.

Answer to Quantitative Research Question 1

Question 1 – Will curricula developed according to principles of brain-based learning result in significant change in students' attitudes towards writing and comfort with the writing situation as measured on a survey for each and on scores on a writing sample?

In this study, students did not demonstrate a significant difference in improvement on a writing sample and surveys of attitude toward writing and comfort with the writing situation on the basis of participating in the Brain-Based and Non-Brain-Based classes.

That the groups showed no significant difference in gain scores may be attributed to the fact that the brain-based group could not be considered a treatment group. First, developmental English instructors use many strategies that are considered brain-based, such as encouraging active learning, group activities, schema building, and considering the affective part of education. Second, the introduction of only one brain-based lesson could not be expected to make a significant difference in a fifteen-week semester. Also, the two faculty would have to be considered novices in brain-based theory, and finally the groups were contaminated with one instructor teaching the brain-based unit to two of her classes, one in the brain-based group and one in the non-brain-based group.

While the quantitative results were not significant, the interviews provided insight into how students and faculty view the learning process. The next section of this chapter will show how faculty's stated concepts and attitudes of teaching developmental students related to brain-based theory and how they felt about implementing a brain-based lesson as well as how students explained their learning process and how they responded (or didn't respond) to those lessons.

Qualitative Results

In order to discover the response of faculty and students to brain-based instruction, a qualitative investigation was conducted. This section reports the results of that investigation. Two faculty members and I developed and presented at least one brain-based lesson to an English 060 class. We each responded to the same sets of questions about developing and presenting those lessons three times over the semester, once before presenting the brain-based lessons, once after presenting the brain-based lesson(s), and again at the conclusion of the semester. Also, we each wrote a journal about the experience at the end of the semester. A total of eight students were interviewed, five of whom completed all three interviews. Like the faculty interviews, the student interviews were conducted at the beginning of the semester, after the brain-based lesson was delivered, and again at the end of the semester. Interview questions are listed in Appendix G.

For this section of Chapter 4, I will first review the concepts of brain-based instruction as it can apply to English 060 classes in answer to Research Question 2. Next, I will present answers to the research questions from each faculty participant. Then I will present responses from students as a group. Finally I will discuss the themes that emerged from the interviews and the unexpected findings.

Brain-based Concepts

Question 2 – How could instruction for English 060 classes at Pikes Peak Community College be designed according to the concepts of brain-based theory?

A brain-based curriculum for English 060 students would relate to the principles identified as brain-based, here taken from the works of Caine & Caine (1994, 1997), Cardellichio & Field (1997), Davis (1997), Diamond & Hopson (1999), Hart (1992), Jenson (1995), Kotulak (1996), Sapolsky (1996), Smilkstein (1998), and Sylwester (1995):

(1) That the brain requires adequate food, water, and rest in order to function at its best (Caine & Caine, 1997; Diamond & Hopson, 1999; Jenson, 1995; Sylwester, 1995).

(2) That emotion can enhance or inhibit learning (Caine & Caine, 1997; Davis, 1997; Hart, 1992; King, 1997; MacClean, 1978; Sylwester, 1995).

(3) That a learner must be active (Cardellichio & Field, 1997; Hart, 1992; Smilkstein, 1998).

(4) That new learning builds on prior learning (Cardellichio & Field, 1997; Hart, 1992; Smilkstein, 1998),

(5) That the brain naturally looks for patterns (Caine & Caine, 1997; Cartullichio & Field, 1997; Hart, 1992) and is attracted to novelty (Caine & Caine, 1997).

(6) That learning is a social activity in that the brain responds to the interaction with others (Caine & Caine, 1997),

(7) That the brain is "plastic" in the sense that it grows and develops in response to its environment and experience, which, along with genetics, makes each brain unique (Caine & Caine, 1994; Diamond & Hopson, 1999; Kotulak, 1996; Smilkstein, 1993; Sylwester, 1995),

(8) That prolonged stress inhibits the capacity to learn and physically destroys brain cells (Diamond & Hopson, 1999; King, 1997; Sapolsky, 1996; Sylwester, 1995),

(9) That the brain stores information in more than one place (Davis, 1997; Kotulak, 1996),

(10) That the brain processes information beyond the learner's awareness and that reflection is an important part of learning and processing information (Caine & Caine, 1997),

(11) That the brain has two memory systems, one relying on facts and memorization of unrelated information and the other (which is always engaged and does not need rehearsal) being inexhaustible and capable of recalling experience instantly (Caine & Caine, 1997; Jensen, 1996),

(12) That the brain perceives information both holistically and by parts and details (Caine & Caine, 1997),

(13) And that learning is enhanced by challenge and inhibited by threat (Caine & Caine, 1997).

The principles suggest teaching strategies that create a supportive emotional instructional climate (#2, #8, and #13), that allow for social interaction (#6), that acknowledge that each student is unique because of genetics and experiences (#7), that

present content both holistically and in parts (#12) and reveal patterns (#5) and connections to their prior knowledge and experiences (#7), and that engage and motivate students (#3), which can be accomplished by creating interest because of their novelty and challenge, such as games and puzzles, and through stories and metaphors (#13, #4, #11), presenting to multiple learning styles to meet students' unique ways of learning and to place information in more than one area of the brain (#7 and #9), and teaching metacognitive strategies and allowing time for reflection (#11).

Bosco's Lesson

Bosco decided to designate a lesson for setting up an in-class comparison/contrast paragraph that would occur the following week. The purpose of the brain-based class was to deepen students' understanding of the concept of comparison and contrast, to enhance students' understanding of the use of comparison and contrast in Mark Twain's "Two Views of the Mississippi," to practice finding similarities and differences between acrobats and students, and to leave the class with an idea of how to develop their ideas and structure a paragraph using comparison and contrast.

Bosco included a variety of elements and activities to gain students' attention, help them relate to the essay by Mark Twain, encourage active participation, and develop their understanding of the concept of comparison and contrast. Her lesson incorporated the following:

Freewrite relating to students' experience of a loss similar to that described by Mark Twain in "Two Views of the Mississippi" relates to the brain-based concepts that the learner must be active (#3), that new learning builds on prior learning (#4), that the brain processes information beyond the learner's awareness and that reflection is an

important part of learning and processing information (#10), and that of tapping into the brain's memory system for recalling experience (#11).

Class discussion of Twain's life and losses and the structure and content of the essay relates to the brain-based concepts that emotion enhances learning (#2) by creating a comfortable discussion environment, that the learner must be active (#3), that new learning builds on prior learning by connecting their experience of loss with losses in Twain's life and loss expressed in the essay (#4), that the brain naturally looks for patterns by discussing the pattern of development in the essay (#5), that learning is social (#6) by students and instructor sharing information, and that the brain processes information beyond the learner's awareness and that reflection is an important part of learning and processing information (#10) by setting up a connection of ideas about loss in their lives, Twain's life, and the essay.

Presentation of Visuals, including overhead pictures of Mark Twain, comparison/contrast organizational patterns presented on the board relates to concepts the brain-based concept that the brain naturally looks for patterns (#5), and that the brain stores information in more that one place (# 9) by presenting information that would go into the visual area of the brain's memory system.

Small group discussion comparing students and acrobats which relates to the brain-based concepts that a learner must be active (#3), that learning is a social activity (#6), and that the brain is enhanced by challenge and inhibited by threat (#13) because this was a challenging activity in a comfortable situation.

Incorporation of humor into the lesson relates to the brain-based concept that emotion can enhance learning (#2).

Model development of a topic sentence for comparison/contrast paper and small group practice in generating a topic sentence relates to the brain-based concepts that the brain naturally looks for patterns (#5), that the brain is a social brain (#6), that the brain perceives information both holistically and by parts and details (#12) and present challenge with support of group and instructor (#13).

Discussion of how to prepare for the in class writing which was scheduled for the following week relates to the brain-based concepts of building schema for in-class essay (#4), looking at parts and wholes of the in-class essay (#12), setting up learning using conscious and unconscious presses (#10) by giving students the opportunity to see a process and pattern for the in-class writing and incorporating metacognitive and reflective strategy and build schema for the in-class writing.

Bosco created an enriched learning situation using a variety of brain-based principles, as indicated above. Bosco's lesson differed from her usual presentation style only in that she added overheads with pictures of Mark Twain and some discussion of his life and how it related to the reading.

Question 3 – How would Bosco respond to brain-based instruction?

Bosco expressed concerns with the brain-based instruction model on a number of levels. In her first interview she questioned the term brain-based, saying

> I just think when people hear that term, if they've been educators for a while, their tendency is to say that most of what we do is brain-based....I mean you say in your study that there are added components and this term has specialized definitions and allows us to look at what we perceive to be some of the lasting things that may happen with our students in the classroom, maybe the growth of another little dendrite even though it doesn't always seem possible and to think that there are physiological ramifications of cognition and the emotional and affective realm in which both of them take place, those connections are interesting to me. (Interview 1, p. 2-3 of 13)

Later in the first interview when I pointed out that the methods she described in teaching her classes were actually brain-based, she said, "Now that you're connecting that to just what I said, I'm beginning to learn what you mean by the term" (Interview 1, p. 13).

Bosco expressed some discomfort in trying something new, but at the same time some enthusiasm to spend time discussing methods. In her journal she says,

> Although I was fearful about the extra time this project would take, I looked forward to working on it as a way to build in time to discuss pedagogy. I didn't really understand 'brain-based learning' and still really don't....So, I actually involved myself in this project as a way to allow myself more time to think about teaching and my assumptions regarding learning rather than as a way to prove the effectiveness of brain-based learning (although if that happened I would certainly have to interrogate my rather skeptical views which would be a good thing too). (Bosco's Journal)

At the same time, Bosco enjoyed the opportunity to think about her teaching as a result of this study, and she enjoyed our interviews. In a personal conversation she said that even though she only presented one lesson for the study, she actually spent a lot of time thinking about her teaching. In her journal she says,

> I liked the opportunity to look at my teaching in a more global and theoretical sense rather than as purely "practice." I think that this helped inform my "practice" as well, however. I spent a lot of time running scenarios of possible 'brain-based' lessons through my head all the while trying to connect these lessons between and among ideas I spoke to in the interview, many of those influenced by Ann Berthoff, Paulo Freire, Ira Shor, and Jacqueline Jones-Royster. (Bosco's Journal)

Bosco expressed disappointment that the lesson did not actually transfer to students' writing. While in her second interview she had said she felt that the lesson exceeded her expectations, in her third interview she reported that her students' enthusiasm during that lesson had not transferred to their actual writing. However, she

attributed that to the fact that as a class the students were very inconsistent in their performance over the semester, that they were at a point in the semester where they were being challenged to synthesize writing concepts and some of the students were just not ready to move forward independently, and that that students in the class (which met at 1:00 PM) was frequently sleepy and hungry. She felt that the lesson was a good one that she would try again. She felt the overheads enhanced students' attention, and she felt that as a result of putting extra effort into weaving the elements into the class, the lesson was fluid and seamless.

Question 4 – Would Bosco perceive that brain-based instruction differs significantly from other instructional models using similar delivery methods?

By the third interview, Bosco still was not convinced that brain-based instruction differed from good instruction, as she said, "I'm still not clear what the difference is between what we do ordinarily in terms of good teaching and brain-based" (Interview 3, p. 6). In her journal she says, "I have to confess to some skepticism about 'brain-based learning' since from what I could gather, it just sounded like good and thoughtful teaching to me."

However, Bosco did feel that the addition of the overheads and the discussion of Mark Twain's life especially in relation to the short story "Two Views of the Mississippi" were helpful for the students. She says in her journal, "I guess what I discovered about the 'brain-based' lesson I actually did was [that] my pooh-poohing of pictures/transparencies about authors was basically a lot of teacher-centric garbage." In her journal she said that she usually assumes that since she doesn't need to see a picture

of Mark Twain, her students don't need to either. So she changed in her awareness of the student perspective in relation to using visuals.

In her journal, Bosco said that the greatest benefit of participating in the study is the opportunity to think about what she does in the classroom: "Oh, I think what has been most valuable for me out of the brain-based stuff than anything else is – is having to sort of step back and – and think very carefully about what I do." Also, she commented several times that the lesson was fluid and seamless, a quality she identified in her first interview as a positive element in instruction.

In truth, however, Bosco's lesson could not be termed uniquely brain-based. In her journal and final interview she said the only new elements were the overheads and the depth of discussion on the author's life as an introduction to the reading. She also used a visual diagram on the white board to present the organization pattern for comparison/contrast papers, which was not a new element to her teaching. The introduction of visuals can be found in Gardner's multiple intelligences, and the information about Mark Twain's life as a connection to the students and the essay being studied can be found in adult education theory as expanding on a student's schema of knowledge.

Rufus's Brain-Based Lesson

Rufus's brain-based lesson was a discussion of a reading selection titled, "McDonald's – We Do It All for You." The purpose of the lesson was to generate student interest and discussion about the article, provide a model for close reading techniques for the essay, and generate ideas for a response paper that students would write in the next couple of weeks. Like Bosco, Rufus presented a lesson that did not

differ from what he usually does in class, except for the addition of transparencies and a discussion of McDonald's and McDonald founder Ray Kroc's life. The brain-based principles demonstrated in his lesson are that the learner must be active (#3), that new learning builds on prior learning (#4) by connecting the setting of the essay with students' experience, that learning is social (#6), and that the brain stores information in more than one place (#9) by presenting visuals, that the brain processes information beyond the learner's awareness (#10) by inputting background information that ties into the essay, that the brain has two memory systems (#11) by tapping into the students' experiences and providing background on McDonald's.

Question 3 – How would Rufus respond to brain-based instruction?

Rufus thought the class went very well and that the familiar topic and visuals contributed to the students' understanding of the material. He commented in his second interview on the immediate and apparent result with students, and in his third interview and journal he addressed the residual effects of the lesson, which he felt were significant.

In his second interview, Rufus stated that he felt the reading engaged the students' attention because many had the experience of working in a fast food restaurant or at least knew some who had done so: "I felt it went pretty good. I had their immediate attention, and because this is a community college and a lot of students are from a working-class background, the essay struck a cord." He also said that the overheads with information about Ray Kroc were interesting to the students because even though some had worked at a McDonald's, no one knew about the founder, even though his picture is displayed at every McDonald's:

> Uh, no one, even a couple of people who have worked for more than a couple of years at McDonald's, knew the name of the founder....And so they – they – got to

> see a picture of Ray Kroc, and . . . this is like going . . . to school for three months and not knowing the instructor's name. There are some things we take for granted, you know, and that continue to surprise us on the part of students.

Rufus said that he thought the discussion during that class lasted longer than usual:

> I did not expect . . . the length of the kind of detailed discussion that went on. Usually . . . with my standard kind of a preparation for a lesson in critical reading, we . . . can manage to carry things along to the English 060 level. . . for 40 minutes or so. Uh, this one went on an hour and twenty minutes, at least. Uh, and I didn't expect the . . . fast food horror stories that . . . came up.

Rufus had hoped that the discussion would elicit deeper thinking about the reading selection, that students would see the finer points of the essay and that students would grow in their sense of how to read an essay critically. His evaluation of the discussion in that regard was mixed. First he said that students were more interested in sharing one "horror story" after another about working at fast food establishments:

> I was not as successful . . . in engaging them in specifics within the text of that reading as I thought I would be. Mainly they just wanted to talk – and lay heavy things on the class like, "You wouldn't believe what's in the ice cream machines" or stories of the dumb workers.

But later in the second interview, Rufus said that he did notice some higher level thinking in the student discussion:

> [W]e already covered the details, and the . . . inner-related cycle where some of the details led to – led to some higher-order thinking. Uh, something – something just occurred to me about the kind of discussion that went on, uh with this piece. There was a lot of comparison thinking. More so at a level that I'm . . . not used to seeing, so there are plenty of things to compare it to.

By the time of Rufus's third interview, students had written their reading response. Rufus reported that several students chose the McDonald's essay, and that he thought their reading response papers reflected the interest in the class discussion:

> [W]hen reading responses were due, I found that a lot of them chose to do a

> reading response on that particular reading. .... Uh, but what I saw was a connection between the class discussion and reading responses is that it stayed with them – when they went home. And they discovered things that they could have contributed during the discussion. And you know, the reading response gave them another - another outlet for that. So that was very good.

All in all, Rufus was pleased with the lesson.

Question 4 – Would Rufus perceive that brain-based instruction differs significantly from other instructional models using similar delivery methods?

For the most part, Rufus's lesson was similar to his usual method of instruction. The one difference is the addition of the overheads:

> I found out, uh, some time ago that, uh, I get much better response papers from students if I let them use the context of a class discussion of the reading to formulate some ideas, uh, and line up some thoughts rather than asking them to do a response on something before we've discussed.

Rufus felt that the inclusion of visuals was a benefit for students, especially visual learners. His response to the lesson can be summarized with the following points: (1) Students demonstrated better thinking because the essay and discussion connected to what they know; (2) There was a higher level of comparison thinking than he was used to seeing; (3) The discussion was more detailed and lasted longer than usual (usually 40 minutes, this time one hour and twenty minutes); (4) The students noticed more details with the essay; (5) Some of the details led to discussion on a higher level of thinking; and (6) there was a residual effect that students' apparently added to the discussion in class in their actual papers which were turned in two weeks later. In his journal, Rufus said,

> Topics covered in the transparencies included Ray Kroc's biography and business philosophy, a picture of the first McDonald's restaurant, some notes on McDonald's philanthropy, and a picture of a McDonald's Happy Meal toy. The

> principal reason for covering such seemingly simple topics through use of the overhead projector was to provide visual clues for those students who are more visually oriented learns. In so far as many people take McDonald's restaurants for granted – they are after all a part of the American landscape – the visual cues caused a number of students to think about the totality of McDonald's, rather than solely about the simple drudgery of a minimum wage job taking orders and frying burgers.

About the inclusion of the overheads, Rufus said in his second interview

> Yes, I could see that it would help them make things more visible. Well, hey, we're more academics. We do well in the talking-head environment, uh. Uh, and I should probably consider students' needs for visual cues, especially at this level, a little more often.

Rufus's response in the third interview to the question of whether or not he felt the methodology had merit was that "This is a solid methodology and it's very logical. That being said, the burden is on the instructor." In other words, Rufus likes the methodology, but cautions that instructors need to let the responsibility of learning reside with the learners.

Again, the added elements of visuals and background material in Rufus's lesson are not uniquely brain-based. It can be found in Gardner's multiple intelligences and schema theory. Relating material to what students already know, as in the fast food stories, can be found in the work of Freire, in schema theory, and in the work of Roueche and Rose.

Tina's Brain-based Lessons

I identified four actual classes that incorporated brain-based principles.

Lesson 1 – Class Discussion of the Writing Process. For this lesson I had the students elicit the elements of the writing process through group discussion. I divided them into groups of four, and I asked them to introduce themselves and choose one

person to be the spokesperson for the group. Then discussed why people write, what's easy about writing, and what's hard about writing. After the small-group discussion, the spokesperson reported to the class the findings of the group, and I compiled the answers on the board. In my journal for that day (August 23), I wrote, "It was great – the students came up with exactly the same things I would have lectured on, but they didn't have to listen to me." I also said that I felt the students appeared to be more interested than they would have been had I lectured to them. In my second interview, I said that the lesson went well and that the students were much more interested in the class as a result of their generating the ideas. This lesson relates to the brain-based concepts that learners must be active (#3) and that learning is social (#6).

Lesson 2 - How the Brain Learns. I actually gave this lesson to both classes, but went into more detail with my brain-based class for the study. In this lesson I used overheads, class discussion, optical illusions, and an acronym to help students think about their own learning process. The lesson began with some overheads of the brain itself and some discussion of the parts of the brain, neurons, and the importance of connections at both the neuronal and cognitive levels. We talked about how emotional stress blocks learning: students in this class as well as past classes relate well to this and can provide examples of people they know who have been stymied by abusive situations in their lives. We talked about the physical needs of the brain for sleep, protein, water, avoidance of drugs, and so on. I also did a short exercise that demonstrated hemisphericity: I asked students to listen and visualize as I read a very descriptive paragraph. Then I asked them a concrete, factual question. Sometimes people can feel the shift from the right, creative hemisphere to the left, analytical hemisphere. In fact, two students said they could sense a

difference when they were asked to think about the reading in a different way. One student had heard of another activity demonstrating hemisphericity. It was reading a word that named a color, but the word is written in a different color. One side of the brain wants to say the color it sees, the other the written word; it is tricky. I'm going to try that another semester. I ended this lesson with a discussion of the aspects of writing that are right and left brained, emphasizing that the proofreading part should be separate from the idea-generating and initial drafting part.

Students had already written a journal about the steps they experienced to become proficient in something they did well. We then compared what they identified as important in learning a skill with elements I had identified in the acronym OATS (which stands for Open Minds, Active Learning, Time and Effort = Success). Then I presented overheads of optical illusions that related to the OATS elements, and as expected, the students really enjoyed the optical illusions. I presented the easier optical illusions first, and I saved the most difficult optical illusion until last. That one is the illusion of a cow's face, and it is very difficult to see for most people without help. Then, when most of the students said that they could see the cow, I asked them to remember when they weren't able to see the cow, and to see if they could look at the picture and NOT see the cow, like they had a few minutes before. And most said they couldn't NOT see the cow, which is to be expected.

Then I said that they were unable to return to NOT being able to see the cow because the ability to see cow in the illusion had entered their short term memory, and that knowledge of seeing that cow in the optical illusion had become part of them. Not something they could buy in a store, but something that became part of them because of

the time and effort investment they had made in learning how to see that cow. I also said it was in their short term memory, and that it might take repetition and reinforcement to move to the long term memory, but it had definitely made a change in them that theoretically could be measured in dendrite growth. Finally, I ended the lesson by reviewing the OATS acronym and some discussion on how that can be applied to college classes.

It is worth mentioning that some of the students do claim to be able to look at the illusion and NOT be able to see the cow. These are the same ones who, when presented with the illusion of the old lady and the young lady or the vases/faces illusion, claim to be able to see both at the same time. The research says that the brain only processes one of the images at a time. I sometimes wonder if these students, who tend to be of the most agreeable type, are really not involved in the class, but agreeing to everything going on because it's what they are used to doing as a way to mask their noninvolvement.

This lesson related to the brain-based concepts that a learner must be active (3), the brain looks for patterns and is attracted to novelty (#5) through using the optical illusions and the acronym, that learning is a social activity (#6) with the class discussion, that the brain stores information in more than one place (#9) through the use of visuals for visual memory, that the brain perceives information both holistically and in parts and details (#12) through references to hemisphericity, and that learning is enhanced by challenge (#13) through the use of optical illusions.

Lesson 3 – Spelling and Neural Linguistic Programming. I emphasize the importance of spelling to the students because so many of them make such elementary mistakes that their writing makes them look illiterate. They misspell words people learn

in the fourth grade (there/their; it's/its; than/then, and so on). I tell them they have to find a way to avoid those spelling errors because they distract readers from the writing. First the students broke into groups, but they were different groups than the last group exercise so they could meet different people. In groups they discussed spelling concerns, and then I compiled their lists of spelling problems on the board. This related to what they knew about spelling and enabled them to be comfortable discussing it.

Next the students shared words that are difficult for them to spell, and we made a list on the board and discussed strategies for the words. We ended the class with a neural linguistic programming activity that is designed to put a spelling word in the visual memory through eye movements. After each student wrote a long and difficult word on an index card, I asked him or her to hold the card above eye level and to the left or right according to their handedness. Then I asked them to view the word one letter at a time, in syllables, as if tracing the word with their eyes as if they were pencils, and finally as if taking a photograph of the word. I also asked them to hold the card to the right or left (according to their handedness) and at the same level as their eyes and pronounce the word softly, and one syllable at a time (to access the auditory part of the brain). I then asked them to visualize the word and write it on a piece of paper without looking at their index card, and they could do that.

I presented one more activity to demonstrate the power of visualization. I asked one student to visualize the word and spell the letters out loud, but in reverse order, while I wrote the letters on the board from right to left. As usually happens, this student was able to say the letters about as fast as I could write them.

To pull it all together and relate to everyday life, we then talked about visualizing as a tool for improved performance, using examples of athletes, performers, and students. I ask them as students to visualize themselves studying for tests, taking tests with confidence, and walking across the graduation stage. The students were pretty quiet about this by the end of the lesson, so I wasn't sure what they thought about it. In my journal of August 28, I wrote, "I don't know how seriously they take this, but I think it could be a powerful lesson." And in my second interview I said that students seemed interested in this lesson, but not really enthusiastic.

This lesson relates to the brain-based concepts that learners must be active (#3), that the brain naturally looks for patterns (#4) in regard to looking at the pattern of the chosen spelling word, that the brain stores information in more than one place (#9) in regard to the use visual memory, that the brain has two memory systems, on for facts and memorization (#11) with this activity tapping into the rote memory system, that the brain perceives information both holistically and in parts and details (#12), and that learning is enhanced by challenge (#13) with the challenge of learning to spell a new word.

Sentence Structure Lesson. This lesson came about serendipitously, and I am counting it as brain-based because it contains brain-based elements and it seems to have reached the students at a deeper level than the other lessons. In my second interview I said that I thought the students were more engaged with this lesson than they were for the other three, and I thought the instruction would "stick more." It started as a spur-of-the-moment, extra point opportunity – I asked questions, and whoever answered correctly got an extra point added to the total points of their grade. At first the questions were easy – right from the syllabus. Then they got harder, and then came the big question – why do

people forget to put commas in their run-on sentences? I could feel a shift in the room – at the beginning of class the students had just received their sentence structure quizzes back, and most were not pleased with their grades, so they wanted the extra points to make up for the low grades, and they also wanted to understand the material because the next quiz would cover the same material. They appeared to be involved in the discussion, and we had lots of discussion and lots of examples on the board.

This lesson relates to the brain-based concepts that a learner must be active (#3) by encouraging participation (even though with an extrinsic reward of points toward grade), that new learning buildings on prior learning (#4) by expanding on their experience with sentence structure, that the brain naturally looks for patterns (#5) by discussing patterns for the sentences, that the brain processes information beyond the learner's awareness and needs reflective time (#10) by presenting information so that students could reflect and build on their schema of sentence structure, that the brain perceives information holistically and in parts and details (#12) by looking at parts of the sentence, and that learning is enhanced by challenge and inhibited by threat (#13) in that there was an absence of threat for this class.

Ten of the fourteen students who took both quiz 4 and quiz 5 were present for that discussion, and I compared the improvement from the first to the second quiz between those present for that discussion and those not present. The result of that comparison is listed in Table 13.

While half of the entire class improved from quiz 4 to quiz 5, 60% of those participating in the class extra point discussion improved compared to 25% of those absent for the class discussion. Also, those not present for the discussion averaged 7

Table 13

Comparison of Quiz Score Improvement after Class Discussion

	Entire Class	Present for Discussion Run-on Sentences	Absent for Discussion Run-on Sentences
Average Quiz 4	63%	62%	69%
Average Quiz 5	66%	71%	54%
Improvement	3 points	9 points	- 15 points
# Students who improved score	7 (50%)*	6 (60%)*	1 (25%)*
# Students who decreased score	7 (50%)*	4 (40%)*	3 (75%)*

*Percent of the group absent or present for discussion

points higher than those present for the discussion on quiz 4, but 15 points lower on quiz 5. The small numbers for this comparison make it hard to prove statistical significance, and this wasn't a planned brain-based lesson. Also, it could be argued that those absent had less interest in the class, and therefore may have been less motivated to improve their scores on the next quiz. However, it was definitely a lesson that held students' attention by starting with what they knew, with absence of threat, and appealing to a need (better score on the next quiz). One important concern about this lesson in relation to brain-based principles is that students were motivated by an external reward (grade), which is in direct opposition to brain-based principles.

Question 3 – How would Tina respond to the brain-based instruction?

I think the brain-based lessons presented to this class went well. Two of them I had used in other semesters: the neural linguistic spelling lesson and the lesson on how the brain learns. I didn't think these two were as successful as I would have liked and as I

had experienced in the past. The group discussion of the writing process and the extra point sentence structure lesson went really well, especially with student attention. As I think about it, for those two lessons I was more of a facilitator and less of an instructor.

Question 4 – Would Tina perceive that brain-based instruction differs significantly from other instructional models using similar delivery methods?

For me, thinking of the workings of the brain in my work with students provides the paradigm in which I view and interpret what is going on in the classroom, even though I still do the same activities and have the same instructional goals as anyone else. Specifically, I think about hooking onto what students already know (dendrite growth), getting students interested (attention theory), helping students feel they can be successful (non-threatening), and creating active learning opportunities, and including visual interest through use of color, diagrams, and overheads with pictures of authors, and relating the material to students' lives.

The literature of developmental education, adult education, and good solid educational practice supports brain-based learning principles as seen in the work of Howard Gardner (multiple intelligences), Kohlberg (learning styles and 4-MAT), Patricia Cross (challenge with support), Reuven Feuerstein (cognitive modifiability), schema theory, Piaget (disequillibrium > learning), Roeche (learned helplessness), 70s theory of a low-threat environment, Dewey, and Paulo Freire (relate learning to life). It also fits the developmental model of education that says that people continue to develop throughout their lifetimes. Therefore, a person following good, established, teaching practices could be employing brain-based instruction under a different name. For me, it brain-based

theory brings everything together, so I like framing the planning and teaching of the concepts in the brain-based learning paradigm.

For me the brain-based theory contributes positively to how I work with students through its framework and paradigm of the operation of the brain. However, I have to acknowledge that someone could come to the same place through a different paradigm.

Question 5 – Do lessons developed using brain-based principles contribute positively to the success of students from the perspective of faculty?

Both Bosco and Rufus had high hopes for the brain-based lesson – they each were enthusiastic after presenting it because of the attention and engagement of the students. So student attention and engagement were significant positive results of the lessons.

While stating that brain-based principles seem no different than good teaching, Bosco acknowledged that the visuals were a good addition and that they reminded her that even though she didn't need "an author's picture or interesting tidbits about him/her to maintain an interest in his/her ideas," her students could benefit from that. However, Bosco did not feel that the visuals, class discussion, small group work, free write, and relating of the content of the essay and Mark Twain's life transferred to the students' writing. Bosco was pleased with the lesson because it was, as she said, "seamless" and engaged the students and captured their attention, but she was disappointed that it did not transfer to student writing.

Rufus felt that the visuals and discussion about McDonald's helped the lessons, helped students relate to the material, contributed to the quality of class discussion and transferred to the student papers. He said that he did have the students' attention and that the class discussion was significantly longer than usual, due as much to the content as to

the visuals. He also said that students uncovered the details of the essay which led to higher order thinking, including more comparison/contrast thinking than he was used to seeing. Rufus said in his third interview that, "Well, hey, we're more academics. We do well in the talking-head environment, and I should probably consider students' needs for visual cues, especially at this level a little more often." He also felt that the students gained insight into critical reading as a result of the discussion.

In the final papers, Rufus noticed that some students who had not participated in the class discussion went home and added extra information that hey had apparently thought about in their reading response essay. So he thought that the quality of discussion helped students pay attention and did transfer into their writing. However, he did caution that the brain-based lessons made it too easy to assign the responsibility of learning to the instructor as opposed to the student. Rufus didn't report any special effort in developing the lesson. Also, he mentioned that he thought the brain-based lesson helped students make connections.

For me the most significant result of brain-based can be deeper thinking, which I think occurred in the lesson in which students discussed their writing process and the lesson on run-ons and comma splices. I think the deeper thinking was the result of students being more interested and attentive to the lessons. Also the use of visuals helps the instructor to be more learner-entered and aware that while as educators we automatically construct own visual images to accompany ideas, concepts, and information, students don't always have the background or inclination to do that.

Also, developmental students think on a more concrete and general level, and I think faculty tend to think with more complexity. So I think faculty can easily not be

unaware when students are missing the point of the instruction because they are not thinking on the same level. I think brain-based principles can stimulate student interest, and of course anything to get the students really interested is great because students can look interested when they are not. Class discussion is really important because students often don't think carefully about the readings on their own. The personal touch is so important, as is a student's feeling of mastery. While these approaches and types of lessons help students, they are found not only in the brain-based paradigm, but also in the adult education paradigm and the composition studies paradigm.

Question 5 – Do lessons developed with brain-based principles contribute positively to the success of students from the perspective of students?

Without knowing that a specific lesson would be evaluated in this study, each student was asked to identify a class or lesson that he or she thought went well. The students were asked this during the second two interviews: once soon after the brain-based lesson was delivered, and once at the end of the semester. In only two of thirteen interviews did answers possibly related to one of the brain-based lessons.

Bosco's student Phil said that he liked what he learned during a class that analyzed a short story. He said that as a result of the class discussion and some background on the political situation relating to that story, he gained insight into not only the story, but also how to analyze fiction. The story he is referring is not the one Bosco used for the brain-based lesson, but the same type of instruction (probably without the visuals) was used for that lesson as for the brain-based lesson.

In my class one student said that she thought the lesson on run-on sentences and comma splices was a good one for her. That may have been my extra point lesson, so this

student, one of three from my class, may actually be referring to my brain-based lesson. This same student said several times over the semester that she liked how I taught and that it was a different method than she was used to and that it worked well for her. She may have been referring to the learning approach, which also can be found outside the arena of brain-based instruction in the area of metacognition.

No student specifically mentioned the use of overheads, visuals, or discussion about the Mark Twain or McDonald's essays. With all the emphasis on visuals in the brain-based lessons, it is surprising that students did not refer to anything visual when asked to describe specific classes that went well. However, the concept of learning with the visual sense did appear in other ways. One student mentioned visual learning in her first interview in response to the question of what kind of learning works well for her. That student was referring to diagrams and information on the board, and she said that she had to see it in order to learn well. She and three other students, referred to themselves as visual learners. So even though students didn't identify visual aspects of the classroom instruction as helpful, they did identify visual presentation of ideas and concepts as helpful and important. It would have to be concluded that students did not identify the brain-based lessons as ones that they thought went particularly well for them.

Question 6 - When faculty and students discuss their experience in their English 060 classes, what themes emerge and how do those themes relate to brain-compatible learning concepts and strategies?

Transcripts of student and faculty interviews were analyzed and coded regarding elements related to student success. Five categories related to student learning emerged from the transcripts: student characteristics, instructor characteristics, factors that aid and

hamper the learning process, the writing process, and outcome of instruction. A sixth category of the administration system contained only three items.

Student Characteristics

A student characteristic emerged when either a faculty or a student referred to a quality of a student. For example, if a student said, "I am a visual learner," that became a subcategory in the Student Characteristics category. However, if the student said, I learn best by seeing, it would be considered a factor in the learning process. Fourteen subcategories emerged from the student characteristics category.

Of the 205 references to student characteristics, faculty generated 145 of them, a trend consistent with the interviews. Faculty identified educational history, apparent learning capability, barriers to learning, student histories, motivation, emotion, and engagement in learning tasks frequently. Both faculty and students spoke to student strengths, and students alone mentioned learning style. Both students and faculty mentioned sleepiness, and one faculty referenced hunger.

Instructor Characteristics

Seven sub-categories emerged regarding instructor characteristics: teaching technique, quality of instruction, theoretical perspectives, reflective comment on teaching, attitudes toward students and teaching, challenge with work, and background. Of the fifty-nine total responses, three came from students, all three about examples of ineffective instruction. Students said they didn't learn with faculty were not clear, when methods were inconsistent, and when instructors assume students have learned the material and move on.

Faculty all mentioned composition and/or learning theorists to back up our ideas about teaching. We were all grounded in theory that we related to our view of learning and teaching. Bosco and Rufus mentioned adult learning theorists and composition theorists while I mentioned adult learning theorists and brain-based theorists. We all mentioned Freire, who is listed with the emancipatory orientation group for this paper.

Instructor Identification of Helpful and Challenging Teaching/Learning Strategies

When asked to describe strategies for English 060 that are successful, instructors identified activities and strategies that corresponded to the brain- based concepts that emotion enhances learning (#2), learning must be active (#3), new learning builds on prior learning (#3), learning is a social activity (#6), the brain stores information in more than one place (#9), the brain has two memory systems (#11), and learning is enhanced by challenge and inhibited by threat (#13) (See Table 14).

When asked to identify challenges for teaching English 060, instructors identified elements relating to the brain-based concepts of the importance of engaging students (#2, #3, and #13), building on prior knowledge and experiences (#4), helping students identify patterns (#5), acknowledging students' individuality (#7), teaching metacognitive strategies and allowing for reflection (#10), and creating interest through challenge with support (#13), as shown in Table 15.

Table 14

Successful English 060 Strategies and Their Correlation to Brain-Based Theory

Successful Activities/Strategies	Identified By	Relates to Brain-Based Concept
Individual attention	Bosco/Tina	2-Emotion can enhance learning
Building a series of successes helps helps establish a rapport, encourages students, and helps them feel capable.	Rufus/Tina	2-Emotion can enhance learning
Never lecture or talk more than 15 or 20 minutes at a time. Elicit from students rather than lecture	Bosco	3- Learners must be active
Make mistakes and have students help figure out the way to go	Rufus	3-Learners must be active 6-Learning is social 13-Learning is enhanced by challenge
Focused freewrite	Bosco/Rufus	3-Learners must be active
Assignments that cause students to struggle with making connections.	Bosco	4-New learning builds on prior learning 13- Challenge with support
Teaching first, second, and third person in relation to audience	Bosco	4-New learning builds on prior learning
Students working in groups	Bosco/Tina	6-Learning is a social activity
Students become best of buddies	Rufus	6-Learning is a social activity
Vary instruction methods	Bosco	9-Brain stores information in more than one place
Stories and visuals	Tina	10-The brain stores information in more than one place 11-The brain has 2 memory systems

Bosco also identified three additional challenges, one with herself and one with the community college educational structure that limits instructors' needs. The challenge with herself is "Not actually doing what I want to do," showing her reflection on her own work in the classroom. The concerns with the system are "feeling the need to cover content" and an "institutional structure not supportive to learning."

Table 15

Challenges for Teaching English 060 Related to Brain-Based Theory

Challenging Area of Instruction	Identified By	Relates to Brain-Based Concepts
Lectures over 15 minutes	Bosco	3-Learner must be active
Not dividing instruction into manageable parts	Bosco	12-Brain perceives information both holistically and in parts
Getting students to notice details	Tina	
Accommodating class of unique individuals	Rufus	7- Brain grows according to environment and experience, making each brain unique
Motivate/engage majority of students in class	Rufus	2-Emotion can enhance or inhibit learning
Getting students to attend	Tina	3-Learner must be active 5-Brain is attracted to novelty 4-New learning builds on prior learning 13-Learning is enhanced by challenge
Getting students to give up believing instructor should be a talking head	Rufus	3-Learner must be active
Getting students to read critically	Rufus	12-Brain perceives information in wholes and parts
Getting students to look for & see connections	Rufus	4-New learning builds on prior learning
Getting students to see relationships	Tina	5-Brain looks for patterns
Getting all students to contribute to group work	Tina	3-Learner must be active
Getting students to think more deeply	Tina	10-The brain processes information beyond the learner's awareness and reflection is an important part of learning and processing information
Students looking like they are understanding when they are not understanding	Tina	3-Learner must be active
Learning syntax	Tina	5-The brain naturally looks for patterns

To overcome the challenges, Bosco says that she uses metacognition in the classroom, she has a variety of ways of getting student feedback, and regarding the systemic concerns, she would like to see a way to do away with the semester system and let students learn at their own pace.

Rufus notes that what really works for English 060 students changes from semester to semester because classes are so different. To overcome challenges, Rufus has found it helpful to build successful experiences into the class, to look at sentences in parts (to understand punctuation), and to make mistakes so students and he work together to solve problems.

Emergent Themes Related to Student Success and the Learning Process

The interviews of faculty and students and the journals of faculty were analyzed to identify themes relating to the learning process and student success. After the interviews were transcribed, a colleague and I read the transcripts individually and then met to begin coding. After coding several interviews together, we coded two interviews separately and compared results with 80% agreement. As I subsequently reviewed the transcripts several times, I discovered additional categories and responses for some of the original categories.

Finally, I summarized faculty interviews along with the responses of their students into another chart that I gave to faculty so that they could (1) corroborate that the responses I had collected correctly represented their ideas and (2) so that they could see how their students responded. Bosco and Rufus were satisfied that the summaries correctly represented their thoughts.

Emergent Themes Related to Student Learning

The Learning Process. This category yielded fifty-five specific items, which were collected into seven subcategories, five of which related to adult learning theory (See Table 16). One surprise was that students highly valued instructor lecture and explanation while instructors were careful to supplement lectures with active learning activities. For

example, Bosco's student Princess said, "I liked when the teacher would just lecture and then she'll give you examples and you can ask questions if you have any." Meanwhile, Bosco said, "I think it works well in English 060 to never talk more than 15 or 20 minutes and then to have students respond back either in terms of a focused free write or questions or summaries of what they thought they heard." And Rufus said, "It's a challenge for those students who believe you should be a talking head."

While all three faculty commented negatively on the traditional behaviorist approach, especially the lecture or "talking head" method, the students offered many positive comments about our lectures, especially as being more easily understood than the book. For example, Bosco's student Princess said, "Um, the lectures are pretty good...She gives really good examples." And Rufus's student Ryoga said in his second interview, "It's easier to catch on to when he makes more sense than the book, and that's why I need it 'cause sometimes the book, I read that, and I'm like, 'That makes no sense.' And he explains, and I'm like, 'That makes sense.'"

Students may be responding not as much to the lecture approach as to efforts of instructors to connect the presentations to the student and create interest in the lectures. Princess likes "how they [instructors] put humor into [lectures] or they put regular living into, you know... She made her story [about how she chose a topic for a paper] really funny to us, and so it made us, you know, want to listen more. We could relate to more situations that way." And my student Pluto said, "When she explains assignments, she does it over and over until she makes sure that we know what we are doing." Students mentioned instructor explanation the most as a successful instructional method with ten responses. They also cited dividing material into manageable parts (4 responses), practice

Table 16

Summary of Emergent Learning Process Elements

Sub-Category	Elements	Sub-Category	Elements
Behaviorist	Instructor Explanation	Cognitive	Divide task into parts
	Lecture		Thread content material
	Worksheets		Create successful experiences
	Practice		Easy tasks
	Formula learning		Seamless Instruction
	Effort/Time		Model Examples
	Repetition		Solicit Student Feedback
	Memorize		Make Connections
	Grades		
	Bonus Points	Constructivist	Questioning
	Homework		Elicit info from student
	Textbook		Read class material
			Present challenges
Social	Small groups		Student helps design instr.
	Class discussion		Learning styles
	Students = best of buddies		
	Students/instructors work Together to solve problems	Humanist	Attend to emotional climate Individual attention
Organization	Syllabus	Use Writing Process	Focused Free write
	Pace of class		Summarize
	Dividing material into manageable parts	Technology	Use computer
Create Interest	Create Unexpected		
	Use humor		
	Stories		
	Make class fun		
	Make each class count		

(4 responses), computer (4 responses), individual attention (4) responses) and putting effort and time into work (4 responses). Their active participation in the learning process seems like the kill and drill that instructors (and brain-based learning theorists such as the Caines) try to avoid.

Instructors, on the other hand, cite visual activities first (10 responses, probably due to the nature of the brain-based lessons they developed for this study), followed by strategies designed to promote more active student involvement: class discussion (8), relating coursework to students' lives (8), helping students make connections (6), and asking questions (5).

The most striking theme that emerges from English 060 student interviews is that students don't think about how they learn. When asked a question like "What kind of instruction works for you?" or "Can you describe a class that went well for you?" several students consistently found themselves at a loss for an answer. A total of nine students were asked what kind of instruction works well for them, six of whom were asked that in each of the three interviews, two for the first interview only, and one for two interviews. So the question was asked a total of twenty-two times, and of those twenty-two times, seven times the answer indicated the student either did not know or did not understand the question. Of a total of thirteen responses from seven students identifying a class that went well, nine responses indicated the student did not know how to respond. Among the student responses were, "Can you repeat that again?" "What do you mean by that?" "I don't know how to answer that question," and "I don't know."

In the interviews, Bosco referred to the benefit of providing instruction in learning strategies four times, Tina referred to it five times, and one of Tina's students referred to it three times. Interestingly, that student is one with a learning disability who had a heightened awareness of learning strategy to begin with. This confirms the research of Boylan and Saxon (2002), Maxwell (2002), and others who note that developmental students need to increase their metacognitive skills.

All faculty mentioned the names of composition and/or learning theorists to back up our ideas about teaching. We were all grounded in theory that we related to our view of learning and teaching. Bosco and Rufus mentioned adult learning theorists and composition theorists while I mentioned adult learning theorists and brain-based theorists. We all mentioned Freire, who is listed with the social/emancipatory orientation group for this paper.

Outcome of Instruction. Faculty and students differed in their views of the outcome of taking developmental English. A comparison of the top ten student and instructor statements in this regard is presented in Table 17. Student views of outcomes are immediate and practical: improved writing, confidence, job preparation, and understanding prerequisite material. Instructor views of outcome of developmental studies relate to the development of the individual: making connections to self/others, improve higher order thinking and conceptual skills, understanding their place in the universe and world. The ideas of grades and dropping out ranked third and forth in instructor outcome identification, and this is probably because of their concern for the high number of students who do drop out and do not achieve good grades. Student focus on grades and performance could be related to the fact that they know they are in the English 060 to bring their writing skills up so they can succeed in the next level English class.

Students referred to confidence as a positive outcome of instruction, which ranked second highest in the outcome of instruction category. It is interesting that confidence was not mentioned by students at all in the first interview and fifteen times in the second and third interviews. Also, the three instructor comments about confidence related to

Table 17

Instructors' and Students' Statements on the Outcome of Developmental English Courses

Instructors			Students		
Rank	Outcome of Instruction	Times Mentioned	Rank	Outcome of Instruction	Times Mentioned
1	Make connections to self and others	13	1	Improved Writing	21
2	Higher order thinking	9	2	Improved confidence	15
3	Grade earned	8	3	Understand prerequisite material	9
4	Drop out	7	3	Improve self	9
5	Conceptual skills	6	5	Writing is easier	6
5	Understand place in universe/world	6	6	Grade	5
7	Critical thinking	5	6	Learn fundamentals	5
7	Understand prerequisite material	5	6	Refresh/brush up	5
7	Improved writing	5	9	Improve self	3
7	Application of ideas	5	10	Drop out	2
			10	Transfer knowledge	2

building confidence in their students as opposed to noticing confidence in their students.

Bosco's comment even related to her brain-based lesson:

> I think with this information [on the life of Mark Twain] and the level of reading in this essay, that they felt challenged, and I think they felt sort of respected like "We can do this."

Rufus said he likes to lead students to a "series of successes" to build confidence. He says,

> Success even on a small scale is important for a lot of these students. And you know, when you can set up a series of activities in which they can be successful, more often than not that is an encouraging thing. ... And I think it serves to reinforce the idea that , "Hey, I'm capable of this," you know, and "I'm making progress." And I think these are important things.

Finally, I concurred with the importance of building student confidence by saying that "Another thing that works is to give them activities that promote and foster success. Then their confidence is raised so they can accept challenges and take risks." The idea of challenging students with support and building successes certainly fits with the idea of brain-based learning, and it also is seen in adult education theory of Patricia Cross (1992).

The writing process. Faculty and students also spoke of the writing process in relation to student success (See Table 18). Both faculty and students comment most frequently on grammar, mechanics, and sentence structure. This makes sense, as sentence level errors are an important component of English 060.

Faculty mentioned analyzing the writing process, audience, and purpose, while students which is considered an important consideration in writing. Of those three, only one student made one reference to analyzing the writing situation. Students were more concerned with getting their ideas from mind to paper, coming up with ideas, and brainstorming, which ranked second, fourth, and ninth, respectively. Paralleling the concern with finding ideas, student interviews were brief, even with open-ended questions. Student responses, even with open-ended questions, were brief. Faculty

Table 18

Student and Faculty Identification of Factors of the Writing Process for Student Success

Instructors			Students		
Rank	Writing	Times Mentioned	Rank	Writing	Times Mentioned
1	Grammar/Mechanics Sentence Structure	12	1	Grammar/Mechanics Sentence Structure	18
2	Comparison/Contrast	9	2	Ideas, mind to paper	11
2	Develop Points	9	2	Proofreading	11
4	Topic Sentences	8	4	Come up with ideas	9
5	General Writing Process	5	5	Organize	6
6	Analyze Writing Situation	4	6	Spelling	5
7	Audience	3	6	Paragraph development	5
7	Purpose	3	6	Journal	5
7	Inclass Writing	3	9	Brainstorming	4
10	Spelling	3	10	Flow	4

responses were lengthy with lots of connections among ideas and examples to back up their points. It is worth noting that faculty mentioned free writing as an important factor in the learning process, but not at all in the writing process, even though they teach it.

Another prominent student theme relates to the content matter of writing. In his first interview, Phil made two references to the fact that he had lots of ideas but had had difficulty getting them on paper. In his second interview he showed progress in that area when he said, "I know I got good ideas and how to put 'em on paper." Rufus's student

Ryoga made three references to the difficulty of getting ideas from mind to paper in the first interview and one reference in the second interview, referring to the difficulty as a "wall." By the third interview Ryoga no longer mentioned that wall, but did mention confidence in his writing and pride in earning an A on the paper. Ryoga attributes success in writing to taking time to (1) chunk ideas together, (2) brainstorm, and (3) organize before writing.

Administrative considerations. Only Bosco mentioned the administrative organization as a factor in student learning. She identified the rigid structure as a barrier to student success. She would like to see more opportunity for students to have support from the institution and learn at their own pace, not be held to a fifteen-week, three hour a week semester system.

Unexpected Findings

Unexpected findings range from what faculty and students think about learning to the nature of the study itself. While the research says that students need to build their metacognitive sense regarding their learning, it is still a surprise when their answers to the interview questions supported that idea. Other unexpected findings relate to views of the benefits collaborative learning opportunities for students and faculty, the overarching theme of change, and the possibility that there are many cases (instead of one) in this study.

The biggest unexpected finding is the degree to which students interviewed in this study do not think about their learning process. As mentioned previously in this chapter, in the interviews, students were asked 22 times to describe learning strategies and

experiences that they found helpful in their learning. Seven of the responses indicated that the students did not know or did not understand the question. Only four of the thirteen times students were asked to identify a class that went well were students able to provide an answer.

Another unexpected finding was the degree to which students and faculty differ in the awareness of the importance of active and social learning. Faculty comments share a thread that students need to be active in the learning process. The idea of active learning appeared in three of the eleven successful strategies they identified and five of the eleven challenges identified in teaching English 060. At the same time, students prefer learning from instructor lecture and explanation. While faculty commented nine times on the benefit of small group work, students did not mention that once.

Another unexpected finding is that the study serendipitously gave faculty an opportunity to take time to discuss pedagogy, which is a rarity. All three of us noted that it was a pleasure to be able to discuss ideas regarding instruction, content, and developmental students with each other. While we see the value of student collaboration in learning, we do not take the time to collaborate among ourselves, and this study afforded us that opportunity.

Change revealed itself as an unexpected and overarching theme in this study. Students were facing changes of adjusting to academic expectations and in actually learning to change aspects of their writing to meet those expectations. That change wasn't always easy and often took more work than students anticipated. Bosco and Rufus subjected themselves to change in their instructional practices as part of participation in this study. Both reported that it was difficult to design a brain-based lesson. Also, Bosco

frequently stated that she was anxious about developing and presenting the brain-based lesson.

Finally, unexpectedly this study be viewed as multiple cases instead of just one. The originally stated case was the experience of incorporating brain-based elements in English 060 instruction. It turns out that each of the instructor experiences is quite different. One big difference was that I incorporated multiple brain-based lessons while Bosco and Rufus each integrated one lesson identified as brain-based. Another difference is the familiarity with brain-based principles and the comfort with incorporating brain-based strategies. I had the most familiarity with brain-based principles and the most comfort in integrating them into instruction, while Bosco had the least familiarity with brain-based principles and the greatest anxiety in presenting her lesson. Rufus had an easier time seeing the brain-based elements in what he already does, while Bosco had a difficult time seeing her instruction as relating to brain-based theory.

Summary

The quantitative measures showed no significant difference between the brain-based and non-brain-based class. This was due to reliability concerns with the writing sample and attitude toward writing survey, contamination of the study with a control group receiving the treatment, the unlikelihood of instructors in the control group not using brain-based strategies, and no significant difference between groups with the t-test.

Instructors mentioned brain-based elements in their description of successful and unsuccessful teaching situations, and the brain-based elements were similar to adult learning theory orientations and composition theory, covering the range of behaviorist,

cognitive, constructivist, humanist, and social orientations. Therefore it is accurate to say that elements of brain-based learning occur in good teaching. The commonalities between brain-based and adult and composition theory relate to learning as a process, experiential learning, active learning, emotional considerations in learning, the value of metacognitive and reflective practices in learning.

The interventions all included visual elements, and a further investigation of the literature revealed that there is interest in the use of visuals for today's complicated world with its great amounts of information. Bosco and Rufus each used overheads in their brain-based lessons. While Bosco thought the visuals helped engage students, she did not see that they engaged in the writing task any better as a result. However, Rufus noted that he thought the students were more engaged in the discussion than usual and also went home and thought about the topic more than usual, and therefore turned in better papers with more depth of thought.

I identified four brain-based lessons, and I thought two of them went very well – both of which were fairly spontaneous. Those were an extra credit discussion on run-ons and comma splices, and student group discussion of their writing process. In both cases students appeared very engaged and enthusiastic. However, my other two brain-based lessons seemed mediocre. I must acknowledge that I do have a bias toward brain-based theory, so I did feel students responded to that kind of instruction. One of my students said frequently in her interview that I had a different learning strategy and explained the material better than most of her past instructors. This student has a learning disability, so the metacognitive material would certainly be of help to her.

Students' interviews were brief compared especially, compared to the well-developed and lengthy instructor interviews. Also, students reported improvement in skill, confidence, and attitude toward writing. Their interview reports were in most cases compatible with their survey responses (See Appendix I). Rufus felt that the brain-based lesson worked well, helped create deeper thinking and student interest, resulting in a significantly longer class discussion. Also, he noticed that students (even some who did not contribute to the class discussion) gave the topic thought at home after the class discussion and brought thoughtful ideas into their response papers. Rufus also cautions that the responsibility of learning resides with the student.

Bosco felt that the brain-based lessons engaged the students; however, she was disappointed that it did not translate into quality student papers. Bosco does not see any difference between –brain-based principles and good teaching practices from composition theory and adult education theory, and she is very skeptical about the growth of dendrites being associated with learning. However, when she described her own process in thinking about, delivering, and reflecting on her brain-based lesson, she mentioned many brain-based principles. She felt she had to make the lesson her own, she had to weave it into her own style, she was nervous, but when she broke things down into parts and looked at connections, it helped her organize and feel comfortable with the lesson. Also, all in all, she said that her brain-based lesson was "fluid" and "seamless."

CHAPTER 5: DISCUSSION

With increasing numbers of under-prepared students entering colleges today, and many of them not succeeding, educators want to maximize the prospects for success for at-risk students as a way to improve their career opportunities and quality of life, to insure an educated population, and support the economic strength of the nation. New technology such as PET scans, MRIs, and EKGs that enable to see the brain in action have added to our knowledge about learning. Brain-based theorists maintain that the principles of brain-based learning will revolutionize education as we know it and will benefit people by preparing them to work and compete in the information age.

According to brain-based theory, teaching and learning are enhanced when curriculum is developed with knowledge of the way the brain places its attention and receives and processes information. Brain-based learning relates to the brain's and mind's physiological, cognitive, and emotional functioning in relation to learning. Brain-based learning theory, adult learning theory, and composition theory share many concepts and teaching strategies such as the recognition of the importance of emotion in learning, the concept of new learning building on prior learning, the importance of active learning, recognition of multiple learning styles making each learner unique, and the constructivist view that learners construct their own understanding of new information based on prior experience. However, it differs in that it considers the physiological factors that relate to learning as opposed to observations of student performance.

The purpose of this study was to discover the presumed effect of integrating brain-based curriculum in developmental English classes at Pikes Peak Community College. For this study, three instructors have created and delivered at least one lesson for developmental studies English 060 English students at Pikes Peak Community College. Student semester improvement was measured using an in class writing sample and two surveys about attitude towards writing (Attitude Towards Writing and Comfort with the Writing Situation). Also, the instructors (including myself) and selected students were interviewed about what they thought helped students improve their writing in this class.

Some contradictions and tensions revealed themselves within the context of this study. First, the two instructors found it challenging to develop brain-based lessons because the usual teaching strategies for developmental students includes methods that would be considered brain-based and the instructors were not well-trained in the finer points of brain-based principles. Although they volunteered for the study and wanted to explore a new theory, they experienced difficulty creating the brain-based lesson. Second, while in the brain-based model, students are assumed to be self-directed and independent learners, many developmental students are passive learners. The students in this study wanted a great amount of direction and support, perhaps because of low confidence or low skill level or both. Also, brain-based principles focus on process and not on content. English 060 instructors also focus on process, but because the students need to achieve a specific level of performance and because of accountability issues with student performance, students were expected to master specific content while being coached on process.

If there is a theme to this study, it is a theme of change. One the larger scale, colleges are experiencing change with the increasing numbers of under-prepared students. Colorado community colleges are experiencing change with the state-mandated standardization of curriculum, and Pikes Peak Community College developmental English classes were experiencing a change in the textbooks for English 060. Students enrolled in English 060 experienced change. By becoming a student, they would add to their knowledge base and learn the culture of academia. Some of the changes in their lives as a result of returning to school could include managing their time differently, thinking critically about their work, looking at their writing a different way, noticing finer points they did not consider before, contributing to class discussions, all of which can be associated with risk and challenge. The faculty in this study were asked to change something about their instruction – to create a different kind of lesson, to examine what they do through interviews and a journal, to enter a new paradigm. Change can be difficult, and change can be exciting. Participants in this study experienced both aspects.

In this chapter I will discuss the results and implications of this study in regard to (1) student response to the interviews and brain-based instruction, (2) faculty implementation of brain-based lesson and response to brain-based instruction, (3) the relationship between brain-based learning, adult learning theory, composition theory, and efforts at reform in American education, and (4) possibilities for additional research.

Student Response to the Interviews and Brain-Based Instruction

Student Comments on Their Learning Process

Student interviews revealed that they do not have an awareness of their learning process, are passive learners, and like to depend on instructors as the authority.

When asked directly how they learn best, students responded that they were hands on and visual learners, corroborating the idea that under-prepared college students do not learn in the traditional way of lecture, study, and test-taking (Casazza, 1999; McCabe, 2000; Schroeder, 1993; Smilkstein, 1995). However, the students most frequently identified instructor explanation (not visuals of hands-on experiences) as the best way for them to learn. Only one of the students actually mentioned a visual element when asked about the best type of instruction, and that student was a learning disabled student (Pluto) who may have had more awareness of and experience in learning styles and instructional methods. Also, while instructors mentioned varying the instructional method to accommodate student learning styles 14 times, there was only 4 student comments related to learning styles, one from a student who said his instructor used "different ways to help me" (Phil, 2nd interview), and 3 comments from the same learning disabled student who had commented on the helpfulness of visual instructional methods.

Also, in responding to the interview questions, students gave very short answers that were general in nature. There was little, if any, elaboration on the questions. This fits with schema theory (Davis, 1991b) and the brain-based concept of building new learning on previous learning (Caine & Caine, 1994, 1997; Smilkstein, 1993; Sylwester, 1995). Students with a greater base of academic experience might give more detailed answers.

The brain-based concept of enriched vs. deprived environments relating to connections and ease in learning new material (Diamond & Hopson, 1999) explains why some DS English students just run with the material and are very successful while others appear to try, but do not get anywhere. Those who do well seem to be people with more life experience, like women in their 30s and 40s, many of whom are parents. First, they

are motivated to do well, but second they have spent some time working, caring for their families, and juggling responsibilities. As a group, they are diligent with their homework and active in the class. From a brain-based perspective, they probably have lots of neural connections. On the other hand, students like those mentioned by McCabe (2000) as being the most needy developmental students who aren't being helped probably have fewer connections on which to build new learning. This can explain why they seem not to process the information – they probably need more repetition, more active processing, more connections, to make information stick. It also explains why they don't appear to make connections easily.

While instructors encourage students to be active in the learning process, students appear to prefer to depend on the instructor as the authority and source of knowledge. Students identified instructor explanation as the practice that worked best in their learning. One student said that he didn't understand the material in the book, but could understand the material much better when the instructor explained it. Another student said she liked instructor explanation with the opportunity to ask questions when she felt the need to do so. Also, while instructors mentioned questioning as a teaching strategy fourteen times, students only mentioned it twice. And one of those times was for students to be able to ask a question so that instructors can elaborate on their explanation of the material, not that students respond to instructors' questions.

While Piaget (1977) and Vygotsky (1962) state that learners need to experience dissonance in order to progress in their learning, either through disequalibrium or the zone of proximal development, developmental students may not want to venture into unsure and uncomfortable territory. Faculty mentioned the importance of presenting

students with challenging activities 10 times, while students did not mention that even once. Three student comments related to the importance of the learning tasks being clear, and another voiced concern with inconsistent methods causing confusion.

According to brain-based learning students learn best when not threatened, and student responses indicated that they wanted to stay in a safe, comfort zone (Caine & Caine, 1997; MacLean, 1978; Sylwester, 2000). Caine and Caine (1997) identify a state of "relaxed alertness" (in which students feel comfortable and confident yet interested, alert, and curious) as a prerequisite for students to take risks and explore an educational task. Calella (1994) notes that students progress through stages of involvement with new material, beginning with "awareness with little involvement" (p. 55). In order for teachers to help students move forward in their learning to focusing on the new material and relating it to themselves, educators need to know something of the student's beginning level of knowledge and interest and move forward, a concept not unfamiliar to adult learning theory and developmental learning theory (Cross, 1981; Davis, 1991 b; Maxwell, 1997; Vgotsky, 1978).

Students who have experienced failure in the educational system may stop trying because they feel that they do not have control over their destinies. The term for this behavior is learned helplessness, and it is explained very well by brain-based theory on the physiological level. According to brain-based theory, students have inputted the idea of not being successful in all parts of their brains, and it is in so many locations and reinforced through so many associations, that it is difficult to counter through ordinary interactions. Also, there is the physical part of downshifting that has been a barrier over the year and contributed to self-fulfilling low expectations of the sense of failure.

The concept of learned helpless is also found in adult learning theory (Maxwell, 1997; Roueche & Roueche, 1993), so it would not be a new concept for developmental educators. However, I know from my experience that I tend to think that the students have control over their motivation and that it seems like an instructor should be able to reason with them to change into positive and confident people, and viewing learned helplessness from as physiological experience helps me understand that it can have an impact on students beyond their conscious control. According to brain-based theory, overcoming negative views of one's ability to be successful can be a physiological state that can be changed, but not easily.

Best teaching from students' perspective. Students identified instructor explanation and examples, clear explanation of tasks and syllabus, and worksheets as beneficial. This agrees with the research of Belcheir, Armstrong, and McKinnon (1998) who found that students preferred clear directions and instructor feedback. In this study, the most frequent student responses for successful teaching methods were instructor explanation (10 responses), dividing material into manageable parts (4 responses), practice (4 responses), use of computers (4 responses), individual attention (4 responses), and putting time and effort into their work (4 responses). While faculty work to help students become active learners, it appears they like to be the recipients of the instruction, although they do feel that time and effort and computers are effective for their learning.

In a traditional and learning-centered delivery of education, instructors dispense information (Caine & Caine, 1997; Sylwester, 2000), and the English 060 students in this study apparently feel comfortable in that learning environment. In a constructivist learning environment, students would be challenged to create their own learning goals,

design their own areas of study, and be less dependent on an instructor. However, the purpose of developmental studies is to provide the requisite skills for college level work. With that in mind, instruction needs to be learning centered because there is a specific skill to be mastered. The students in this study clearly wanted direction in their learning. Therefore the role of the instructor might be one of helping dependent students not only master the content, but also (and very importantly) make the transition to independent and self-directed learning. In order to do so, instructors may need to provide the most inexperienced and under-prepared students more direction and at the same time challenge the more capable students (Grow, 1991).

According to brain-based theory, capturing a student's interest and engaging his natural curiosity is sufficient to involve the student in the learning process (Caine & Caine, 1994, 1997; Hart, 1992; Sylwester, 1995, 2000). In the classroom this does not happen as easily, and it is probably the students who are most untraditional and would most benefit from brain-based and learner-centered methods who seem unresponsive. Maybe it's just that we haven't captured their interest enough, but it just seems like the students are very passive. Bosco was referring to this when she said that even though the students were attentive to and enjoyed the brain-based lesson, there was no transfer to their mastery of the material. It makes sense that students need to be engaged and interested if they are to progress, but being engaged and interested is not enough by itself. It could be that they need to build neural connections and a schema in order to relate to the academic expectations. It could be as Grow (1991) says that they need to learn to be independent learners.

Student perceptions of the outcome of instruction. Because students are required to take English 060 on the basis of their placement score, it would be natural for them to identify the desired outcome of taking the class as improving their skills so they can be allowed to take the next level class and eventually take college level English. Therefore, their goals would be expected to be short term and related to mastery.

This was the case with 6 of the top 11 of the students' outcome responses relating to improved skill development. Students commented 21 times that they anticipated improved writing as an outcome of the class (either desired or experienced). Other responses related to writing skill were: understanding prerequisite material (ranking 3rd with 9 comments), finding writing easier (ranking 5th with six comments), earning a grade, learning the fundamentals, and refreshing/brushing up (tied for 6th with 5 comments each).

Improved confidence ranked 2nd with 15 responses. Interestingly, each faculty mentioned student confidence once in the first interview, but not again. And students only mentioned improved confidence in the second and third interviews, but not the first. This suggests that students did not anticipate improved confidence as an outcome of the class, but after the first third of the semester they noticed that they were more confident.

Students' perceptions related to brain-based learning principles. Students' comments when asked to identify elements that helped them learn related to nine of the thirteen brain-based principles:

Principle 2 – Emotion can enhance or inhibit learning. They said that when instructors were "funny," it helped them remember, and they liked individual attention

and when instructors created successful experiences for them. One also mentioned that the "easy pace," which can be interpreted as unstressful, was helpful for her.

Principle 3 – A learner must be active. The students identified instructor questioning and opportunity for them to ask questions, time and effort on task, homework, worksheets, and class discussion as elements that helped them learn. It might be pointed out that these elements comprise traditional school practices.

Principle 4 – New learning builds on prior learning. While students did not specifically say that they noticed that they need a background or foundation to understand new material, they did say with frequency that they expected that what they learned in English 060 would provide a foundation for the next level English.

Principle 9 – The brain stories information in more than one place, so that varying the type of learning activity is helpful. There was an inconsistency here. Although several students said that they were visual and hands-on learners, they did not identify visual elements as successful teaching strategies. Only one said she liked diagrams and visuals as part of class presentations. Instead, they said they learned best through instructor explanation.

Principle 10 – The brain processes information beyond the learner's awareness, and reflection is an important part of learning and processing information. The students said they like to experiment and brainstorm.

Principle 11 – The brain has two memory systems, one for rote memory and one for stories and experiences. Students liked when instructors included stories in instruction, and they said that practice and repetition were helpful to their learning.

Principle 12 – The brain perceives information holistically and in parts. Students like when information is divided into manageable parts.

Missing from student interviews are principles #1 (the brain's physical needs), #5 (the brain looks for patterns), #6 (the social aspect of learning), #7 (the brain is plastic and each brain is unique), #8 (stress inhibits learning on a physical level), and #13 (learning is enhanced with challenge and inhibited with threat). It is worth noting that students did not identify working with peers in groups as a helpful practice, which could indicate that students look to the instructor as the authority in the classroom. This correlates with Cross's (1992) findings that adults in an evening freshman English class did not value peer evaluations as a means to improve writing.

Faculty Implementation of Brain-Based Lesson and Response to Brain-Based Instruction

Implementation of Brain-Based Elements

All three instructors used visual elements in their brain-based classes for this study, so I returned to the literature to find information on the effect of using visual stimuli.

Caine and Caine (1994) note that the brain has a natural ability to recognize visual patterns, so they recommend the use of diagrams, charts, and other visual elements. Sylwester (1995) and Howard (1994) report that 70% of our body's sensory receptors are located in the eyes to process visual images, and those receptors send messages to at least eight different a brain areas for processing (Carter, 1998). Hyerle (2000) notes that studies have shown that the brain has an "almost unlimited" (p. 31) capacity to retain

visual images. He refers to one study in which subjects were presented with 10,000 images and were able to remember 9,000 of them, 90%. Others say that visual information helps people keep track of the ever-increasing amount of facts and details in today's information world, and the visual form enables people to retain and understand abstract concepts (Battaglia, 2001; Hyerle, 2000; Materna, 2000).

Bosco, Rufus, and I all use visual diagrams to illustrate paragraph organization and sentence patterns. For the brain-based lessons, we included overhead pictures relating to essays that were discussed in class.

In developing the brain-based lessons, Rufus and Bosco only added two new elements: the inclusion of overheads relating to a reading and including pictures and information about the author of the reading. Both said that the visuals and discussion increased attention and engagement of students. After delivering the lesson, both thought that the increased attention and engagement would transfer to student performance on their papers, but only Rufus found this to be true.

Bosco thought the visuals helped engage the students while Rufus thought they actually helped lead them to more abstract thinking. Bosco said that the visuals helped engage the students but did not assist in transfer of knowledge and skills. Bosco said, "I don't know if that's really directly about their learning as much as it is about something that they enjoyed." Rufus said, "The visuals contributed much to the class discussion." He also suggested using visuals to present a lesson on a subject with which the students were not familiar, so that "instead of just a connection with a previous experience, it would motivate them to go out and do some work on their own, so it would be a prompt to engage them in a heightened level of discovery."

I really like using visuals because I know that I automatically make pictures in my head, and visuals help me remember. Also, I have a schema of visual images that I call up in association with ideas. For me, no discussion of Mark Twain could occur without my picturing him as a white-haired man in a white suit. However, I have discovered that many students today do not appear to have such a reserve of visual images to enrich their learning. Therefore, I feel that presenting relevant pictures helps students build schema for future learning. I think it is easy for instructors to assume that students have a built-in schema for many of the ideas presented in class when they actually do not, so building schema I think helps.

The use of visual elements is certainly brain-based, and instructors are familiar with that technique from Gardner's theory of multiple intelligences, and they don't necessarily need to study brain-based learning to see the benefits of including visuals in a class. However, I think there is a difference between how Bosco and I view using visuals for instruction. Bosco said that when she noticed how the visuals helped students engage in the class, she acknowledged that her "pooh-poohing" of using transparencies had been "basically a lot of teacher-centric garbage," but still she saw them as primarily helping students become interested in the class. Also, I see visuals as more important than just engaging students – I see them as helping students expand their schema and knowledge base; I even see them as growing dendrites and neuronal connections as a result of using them. I believe Rufus is some place between Bosco and I regarding the use of visuals.

Instructor Strategies for Teaching Developmental Students

Strategies identified by instructors as important elements in student success fit the brain-based model. They focused on active learning techniques, engaging students by relating to what they know and are interested in, attending to emotional needs by building confidence, providing opportunities for social interaction, and working with students individually. In applying those strategies, instructors would be using the theories of Freire (1986), Berthoff (1984), Rose 1989), Boylan, Bonham, & Bliss (1994), Roeche & Roueche (1999a, 1999b), Cross & Steadman (1996), and Davis (1991b). Table 19 identifies the top eleven successful strategies identified by faculty and their relation to brain-based learning theory and adult learning theory orientations.

As seen in Table 19, we all ascribe to the cognitive, constructivist, humanist, and social orientations of adult learning theory. Rufus commented that in a previous semester one class of students "became best of buddies," which he felt contributed greatly to their learning. We all value helping students be active in the learning process, presenting challenges with support, building schema, encouraging group activities, attending to the affective aspect of learning, varying the learning mode, and creating interest through humor (Bosco) and making mistakes (Rufus).

Also, the Caines (1995) advocate abolishing the need to cover specific content in a given period of time. This is for two reasons: students learn at different rates and the development of a positive attitude toward learning and development would abolish the need for content since it would give students the tools needed to direct their own education.

Table 19

Successful English 060 Strategies and Their Correlation to Brain-Based Theory

Successful Activities/Strategies	Identified By	Relates to Brain-Based Concept	Relates to Adult Learning Theory
Give students individual attention	Bosco/Tina	2-Emotion can enhance learning	Humanist Orientation
Build a series of successes helps establish a rapport, encourages students, and helps them feel capable.	Rufus/Tina	2-Emotion can enhance learning	Cognitive Orientation Humanist Orientation
Never lecture or talk more than 15 or 20 minutes at a time. Elicit from students rather than lecture	Bosco	3- Learners must be active	Constructivist Orientation
Make mistakes and have students help figure out the way to go	Rufus	3-Learners must be active 6-Learning is social 13-Learning is enhanced by challenge	Constructivist Orientation Cognitive Orientation
Focused freewrite	Bosco/Rufus	3-Learners must be active	Cognitive Orientation Constructivist Orientation
Assignments that cause students to struggle with making connections.	Bosco	4-New learning builds on prior learning 13- Challenge with support	Cognitive Orientation Humanist Orientation
Teaching first, second, and third person in relation to audience	Bosco	4-New learning builds on prior learning	Cognitive Orientation
Have students work in groups	Bosco/Tina	6-Learning is a social activity	Social Orientation
Students became best of buddies	Rufus	6-Learning is a social activity	Social Orientation
Vary instruction methods	Bosco	9-Brain stores information in more than one place	Constructivist Orientation
Stories and visuals	Tina	10-The brain stores information in more than one place 11-The brain has 2 memory systems	Constructivist Orientation Humanist Orientation

Bosco agrees with the brain-based concept of not being restricted by having to cover content in a prescribed period of time, but she – like the rest of us – is bound by the educational system and the mission we feel to prepare students according to prescribed skills to succeed in future courses. The brain-based concept of teaching without content boundaries is appealing, but would not seem practical to community college developmental English instructors.

Brain-based theorists (Sylwester, 1995 & 2000; Caine & Caine, 1997) advocate changing the grading system, which is not a foreign concept to developmental and composition faculty. However, again, students whose expectations stem from traditional instruction may not be ready to move to a new grading system, especially if they are expected to be self-directed learners. Of the brain-based classes I identified for this study, it is interesting that the one evoking the most student engagement is the extra-point activity – obviously the students were buying into the importance of grades. But at the same time it was a nonthreatening activity, success was guaranteed, and students had a stake in the discussion and a real chance for success in raising their grade by answering questions and improving their understanding of the material for the next quiz.

However, for me three things make brain-based learning theory different. First, it relates to the physiology of the brain. Second, it is more comprehensive than any one of the theories, and it brings theories, each with its own discrete focus, together. And third, it is learner-centered in a stronger way than the other theories.

The biggest difference that I see between brain-based learning and other theories is the idea of learner-centeredness, which is an elusive concept. This concept relates to

the constructivist view that learners need to construct their own meaning of information and concepts. This is even expressed by Dewey well before brain-based theory came about. Every developmental educator would agree with the constructivist view, but the difference comes in the degree of student-initiated participation in the process. In brain-based theory, instructor and students work side by side as a community of learners. In the traditional class, the instructor plans the activities, delivers the instruction, and the students follow the directions. The extent of student-directedness in English 060 classes appears limited to student choice of essay topics.

In *Education on the Edge of Possibility*, the Caines (1997) advocate self-directedness in which students choose the content of their studies and set their own timelines. While developmental education is in agreement with the idea that education is process-based, the idea of doing away with content is in direct conflict with developmental education, which focuses on building content necessary for the next level of instruction. In fact, from a brain-based perspective, the purpose of developmental education is to build on students' current levels of writing skill and bring them to a beginning level of college writing – which involves building content.

Developmental English textbooks recognize the importance of students being active and reflective, and now some of them include teaching tips related to active learning and even learning style inventories. Smilkstein (1999) markets a developmental English book that uses and promotes brain-based principles, with students actually drawing neurons with branches to show how much they know when they start a new section and how much they learned when they finish the section.

Instructor Response to Brain-Based Learning Principles/Processing

In the interviews, Bosco talked a lot about her experience in trying something new, and what she identified paralleled student comments in learning the English. Bosco and to make the material her own, she had to relate it to what she knew; she had to practice. Also, Bosco made several references to the importance of making connections and fluidity of the instruction, especially in relation to her brain-based lesson.

Bosco reported the same experience as students regarding adding a brain-based focus to her teaching. She said she had to make the material hers. She said

> I had to make it mine somehow you know it's kind of like you have to take that information and then weave it into what you've been doing all semester long, but at the same time use the newness of it to sort of push me to go on and try some different things in the future, so you know I felt very good about it (Bosco, third interview)

In her initial interview she says that having students "Struggle in making connections" is an important teaching strategy for developmental students. In planning her brain-based lesson, she said what enabled her to overcome her nervousness was to "look at the linkages between each thing." In regard to integrating brain-based principles into her lesson, Bosco said,

> You know, it's kind of like you've got to take that information and then weave it into what you've been doing sort of all semester long, but at the same time use the newness of it to sort of push me to go on and try some different things in the future, so I think it's a great lesson. (Bosco, Journal 2)

In trying out something new, Bosco became a student, and as such she exemplified brain-based learning principles in her own attempt to consider a new theory. First, she needed to relate the new material to what she already knew, which she did in her discussions of the theorists she relates to. Also, pointing out examples of brain-based

teaching in her own teaching helped her understanding of brain-based principles. Second, she had to make the material her own. In her second interview when discussing how it felt planning the brain-based lesson, she said when she tries something new, she needs "to make that mine somehow." In her journal, she said, "I did make it my own, but I realized that one of the things that I continually confront and that this whole experience has allowed me to confront is this sort of feeling of I have to do it myself." Also, there was some discomfort that she found led to growth in the end. She says in her journal that it was a crazy semester with a new book, curriculum that was changing, and two studies:

> I felt that not too much in my teaching was smooth or secure for me – however, I also felt at the end of the semester that my students had (surprisingly) learned much of what I wanted them to learn. This means that comfortable teaching (when I think I know what I'm doing most of the time) is not necessarily the best kind of teaching for teachers. When I'm comfortable I question myself less and assume more. That feeling has carried with me this semester and I feel more free to experiment and question."

What Bosco liked about this study was the opportunity to step back and think about her instruction and to talk about theory in the interviews. Bosco said that as a result of the extra attention she spent on planning the lessons, they were seamless and fluid. She also felt that she had unjustly pooh-poohed the idea of using visuals in her classes by assuming that students didn't need those any more than she did. Rufus made a similar statement about underestimating students' need for visual information as opposed to faculty who were comfortable in the "talking head" area. Again, the inclusion of visual material can be found in the work of Gardner.

In her journal she said, "A lot of stuff just kept simmering around in my unconscious and then cropped up at (usually) felicitous moments."

Next, Bosco expressed anxiety out of trying something so different, and she said she had to "make it my own" in order to do it well. So she considered the two times she gave the lesson as her practice times that got her familiar enough to let the lessons become part of her own style. This was just like what the students said they needed to do to learn material, make it their own. Also, Bosco expressed anxiety over the lesson. In both her second interview and her journal she said that she "was all nervous and weirded out" about what to choose for her lesson, and she had hoped to do something more complex, but settled on something more doable. She said at the end of her first interview:

> I have some things in mind. I want to do some stuff that takes some concepts that I find particularly difficult for 060 students to deal with. And I want to build about a three to four part deal with that would begin with articulating what they think this thing is, getting their understanding of it, connecting that with the understanding of it that they're going to need to address in this particular instance and then moving into three or four ways of maybe teaching that, and then doing some metacognition after that.

In her journal she said, "A lot of stuff just kept simmering around in my unconscious and then cropped up at (usually) felicitous moments," which reflects the brain-based principle that the brain processes information without our conscious awareness (Caine and Caine, 1997). Although Bosco felt that brain-based learning was nothing more than good teaching, she actually described her own experience in thinking through a different type of lesson in brain-based terms.

Rufus's response to the brain-based principles could be summarized succinctly in his statement, "This methodology is solid methodology, and it is very logical when you think about it. That said, the burden is on the instructor." He is saying that he wants the class to remain learner-centered, which also fits with students being active in the learning process. This is a good comment, and a difficult area for developmental faculty who put

so much energy in creating just the perfect lesson to get every student to succeed. The idea that the instructor bears the primary responsibility for engaging students and their ultimate success is unrealistic.

I do think that brain-based theory offers the best explanations as to why some students have a hard time learning what seems to be the simplest material and to explain the phenomenon of learned helplessness, but I think that the idea of self-directedness of students is a difficult one for developmental students. The Caines (1995) say that students will do better if they choose their own curriculum, but typically the weaker developmental students are at a loss of what to choose to do.

For this study, thirteen brain-based principles were identified, most of which were familiar to students and faculty. Table 19 lists identification of one of the thirteen brain-based principles by adult learning theory, students, instructors, and lessons generated by instructors for this study.

If one were to identify brain-based instruction as distinct from other learning theories because it relates learning to physiology, is comprehensive, and is learner-centered, the question remains as to whether or not instructor awareness of brain-based theory will benefit Developmental English students. I still I can't help but wonder if relating what is going on the developmental education principles would accomplish the same thing. For me, the brain-based approach helps me focus on students moving beyond what they seem to think education is – acquisition of surface knowledge. I think it can contribute greatly to student success. However the most exciting part about brain-based instruction and learning is that it is like peeling an onion – uncovering one approach, idea, concept leads to another and another and another.

Instructors' Comments Related to the Thirteen Brain-Based Principles Identified in This Study

Brain-based strategies commonly used by developmental educators include attention to the emotional climate (#2 emotion can enhance or inhibit learning), encouraging active learning in students (#3 learners must be active), connecting to a person's life (#4, new learning builds on prior learning), collaborative learning (#6, learning is a social activity), presenting material in alternative learning styles (#9, the brain stores information in more than one place), and presenting challenging material with support (#13).

In their interviews, instructors identified the following factors as important in student learning in relation to brain-based principles:

Principle 2 – Emotion can enhance or inhibit learning. Bosco and I both identified individual attention as important, while Rufus and I both advocate building successful experiences to establish rapport with students, encourage them, and help them feel capable. In our first interview, all three of us identified building student confidence as an outcome of the class, and students in their second and third interviews identified increased confidence as an outcome of the class.

Principle 3 – Learners must be active. Bosco, Rufus, and I all expressed that learners need to take an active role in their learning. We advocate this through limited use of lecture, asking questions, having students help us solve problems, focused free writes.

Principle 4 – New learning builds on prior learning. Bosco advocated this when she talked about threading material and using point of view (first, second, and third person) to lead to an understanding of audience.

Principle 6 – Learning is a social activity. All of us identify this as important when we advocate students working in small groups. Interestingly, no students identified group work as helpful in their learning.

Principle 9 – The brain stores information in more than one place. Bosco, Rufus, and I all identify this as reason to present to the class with not only lecture, but also stories, visuals, discussions, and student presentations. This relates to Gardner's multiple intelligences and Kolb's experiential learning.

Principle 11 – The brain has two memory systems, one for experience and one for rote learning. Bosco, Rufus, and I all identified this as important through use of visuals, stories, and mnemonic devices.

Principle 13 – Learning is enhanced with challenge when instructors offer support and inhibited by threat. All three of us are familiar with the idea of presenting challenging information while supporting students from the work of Cross (1996b). Rufus said he makes mistakes to get students working on problems with him, Bosco likes to create assignments that cause students to struggle with making connections.

We have identified seven of the thirteen brain-based principles as strategies for student success, and in our lessons we have employed ten of them, all but Principles #1 (the physiological needs of the brain), # 7 (that each person's brain develops in response to his or her environment, making each person unique), and #8 (that prolonged stress inhibits the capacity to learn and destroys brain cells).

Table 20 illustrates the Brain-based Principles identified by instructors and students as beneficial, used in brain-based lessons, and associated with adult, developmental, and composition theory. Not cited were Principles #1, the physical needs of the brain and

Table 20

Brain-Based Principles, Adult Learning Theory, Identification by Instructors and Students, and Found in Lessons Developed for This Study

Brain-Based Principle	Adult, Developmental, & Comp Learning Theory	Mentioned in Interviews		Found in Lessons		
		Student	Faculty	Bosco	Rufus	Tina
1 – Physiological Needs of Brain	No	No	No	No	No	No
2 – Emotion impacts learning	Yes	Yes	Yes	Yes	No	No
3 – Learner must be active	Yes	Yes	Yes	Yes	Yes	Yes
4 – New learning builds on prior learning	Yes	Yes	Yes	Yes	Yes	Yes
5 – The brain naturally looks for patterns and and is attracted to novelty	No	No	No	Yes	No	Yes
6 – Learning is social	Yes	No	Yes	Yes	Yes	Yes
7 - Brain is plastic, unique	Yes	No	Yes	Yes	Yes	Yes
8 – Stress inhibits learning on physical level	No	No	No	No	No	No
9- Brain stores info in multiple locations	Yes	Yes	Yes	Yes	Yes	Yes
10- Brain processes information beyond learners awareness	Yes	Yes	Yes	Yes	Yes	Yes
11 – Brain has 2 memory systems	Yes	Yes	Yes	Yes	Yes	Yes
12 – Brain perceives holistically & in parts	Yes	Yes	Yes	No	Yes	Yes
13 – Learning is enhanced by challenge	Yes	No	Yes	No	Yes	Yes

8, that prolonged stress inhibits learning and physically destroys brain cells.

While Rufus and Bosco mentioned that the new learning builds on prior learning (#3) and that each brain is plastic, unique (#7), probably interpret that from a learning style and schema perspective as opposed to the brain-based physiological view that neural connections actual grow as a result of learning (Caine & Caine, 1997; Smilkstein, 1995; Sylwester, 1995). In fact, Bosco said that she doubted that dendrites really grew as a result of brain activity. Just like students who need a background and schema for new information, Bosco might not have enough background to connect what she believes about learning with the physiology of the brain. Rufus, on the other hand, acknowledges that dendrite growth along with learning is possible.

Also, while #10 (the brain processes information beyond the learner's awareness and reflection is an important part of learning and processing information), stimulating unconscious processes was not mentioned except by Rufus who said that students went home and thought about the class and were able to add to the discussion in their response papers.

Brain-Based Learning Theory, Adult and Developmental Learning Theory, Composition Theory, and Reform in American Education

The literature review revealed that brain-based principles could be found in the five theoretical orientations of learning: behavioral, cognitive, constructivist, humanist, and social (See Table 14 in Chapter 2).

While each orientation represents a unique focus, theorists and teachers actually practice their craft with a blend of orientations to create a rich learning environment. For

example, Freire (1986), who is known for his view of education as an emancipatory activity, may utilize rote learning techniques (which his method does employ and which would certainly be considered a behaviorist method) to enable adults to begin the process of learning to read, and a cognitive orientation in carefully selecting vocabulary that connects to adults' everyday lives for literacy development. In the same way, developmental education strives to build skills necessary for college success by focusing on basic skill development and relating instruction to everyday life.

Brain-based principles occur in all of the orientations. Furthermore, the orientations can be divided into those with a learning-centered approach (behaviorist and cognitivist) and those with a learner-centered approach (constructivist, humanist, and social/empancipatory). While all three instructors in this study at times use strategies from all of the orientations, we definitely have a preference for the more learner-centered orientations of constructivist, humanist, and social, which actually was promoted by Dewey in the 19th century.

Dewey (1938) described traditional education as "acquisition of what is already incorporated in books and in the heads of the elders," in which "isolated skills and techniques" are taught as "a finished product" (p. 19). However, the new, experiential, progressive education would be process-oriented and based on experience of the real world. Rather than teaching from standardized, pre-selected material, with a focus on the next exam and the next class, Dewey advocated selection of content by "improvisation" (p. 78), taking advantage of special moments to design dynamic curriculum. This is exactly what Rufus wanted to gain from learning about brain-based theory, a sense of how to move spontaneously, taking a cue from the class dynamics.

Dewey (1938) cautions, however, that a progressive educator needs to transcend the boundaries of traditional school because it is tempting to try new techniques yet stay within the conventional school system, saying that a change requires a move from the old model to a new one. Seymour (1991) and Caine and Caine (1997) point out that too often reform fails because people try to implement new methods in the same paradigm. Caine and Caine (1997) say,

> Our impressions of much of the current work on teacher development and restructuring is that it operates at the level of developing new modes of doing things, but not at the deeper level of becoming the sorts of people who can do things differently. One reason why so much in education does not change is that people implement new strategies from the point of view of their current mental model – an aspect of their orientation. (p. 227)

Desimone (2002) identifies two recent waves of school reform, the first in response to *A Nation At Risk* and calling for increased standards and regulations, and the second focused on professional development for teachers and addressing needs of special groups of students. Colorado Community Colleges are definitely moving towards increased standards and regulations as evidenced by the current standardization of curriculum, known as the Common Course Numbering (CNS) project in which developmental and core courses (Community Colleges of Colorado, 2003).

Desimone (2002) argues that to be successful, school reform must be specific in that information about its implementation is clear and understood by all involved and requires authority, stability, and a strong context in which to operate. Also, she says that reform works best when consistent with other school activities. Windschitl (2002) states that understanding of philosophical, psychological, and epistemological orientations, as

well as a commitment to student-centeredness, are necessary for the successful implementation of constructivist methods.

The Caines (1997), Dewey (1938), Sylwester (2000), and even Bosco see a need to become more learner-centered by loosening the traditional school structure. Bosco said she felt that the need to cover content in the required three hours a week and fifteen-week semester was not supportive to students and to learning. The brain-based principles also support students directing their learning and moving at their own pace Caine & Caine, 1997; Sylwester, 2000).

When Maricopa Community College examined itself to determine how it could become more learner-centered, it discovered that many of its procedures were cumbersome for students, and it decided to streamline procedures from student advising to registering to publicizing programs and classes (Elsner, 1996). Through support of the CEO, involvement of all campus constituencies, and commitment to students, Maricopa is becoming more learner-centered:

> Maricopa's ...learner-centered system efforts constitute a search for a new learning paradigm. . . . Collaborative processes are more promising because: 1) they are more effective in achieving focused results; 2) they touch the smaller units of our organizations, colleges and universities; and 3) the hierarchical "top-down" approach has proven to be less effective, often making us frozen to act or to commit. (Elsner, 1996, p. 17)

In relation to instruction, learner-centered principles involve cognitive and metacognitive factors, motivational and affective factors, developmental and social factors, and individual differences factors (American Psychological Association, 2003). Learners are encouraged to be self-directed, reflective, strategic thinkers, constructivists, motivated, and success-oriented. However, as shown by this study and others,

developmental students depend on instructors (favoring instructor explanation) and are not reflective about their learning (as evidenced by their confusion in answering the question, "Can you identify a class that went well for you?"). This is supported in the research of Boylan (2002), Grow (1991), McCabe (2000), and Roueche and Roueche (1999).

According to the brain-based principle stating that new learning builds on prior learning, some developmental students may need to build a schema of the basics in order to progress to become independent and self-directed learners (Caine & Caine, 1997; Sylwester, 2000). Therefore, part of the developmental educator's task becomes meeting students at their levels and helping them develop not only skills for college, but also an efficacy toward learning and an awareness of their own learning process (Maxwell, 1997).

Caine and Caine (1997) identified three perceptual orientations of faculty when they attempted to implement brain-based curriculum into a school system. The three orientations reflected shifts in perceptions. They felt that a brain-based perceptual orientation is what will be needed for the 21st Century:

> They [teachers] will need to have the self-efficacy to deal with a fluid, yet frequently dysfunctional, system. They will need to have mastered the art of facilitating self-organization by students and others. They will need to have sufficiently broad cognitive horizons to be able to integrate new ideas and new information and to facilitate their introduction into ongoing and dynamic student experience. They will need to be able to face and know themselves and interact authentically with the people with whom they deal. And they will need to engage in the deep reflection and self-reference that makes constantly growing and adapting to a rapidly changing world possible (p. 226)

The new paradigm involves moving from linear to holistic thinking and focusing on relationships and connections, not unlike chaos theory. Rufus may have been thinking

of the new paradigm when he said he wanted to "develop a schema of steps that I could take, uh, you know lead to that kind of engagement in the classroom [so that] if it's apparent something isn't working, I have the next step – to consider – because classroom plans change" (second interview). Such a new paradigm has been evident in the adult learning theory orientation shift from behaviorist to constructivist, in the move from product-focused to process-focused composition, and is reflected in brain-based learning with its emphasis on the whole person: cognitive, emotional, and physical. However, how if and how such a paradigm can manifest itself in the community college classroom remains to be seen.

For Further Research

Brain-based principles relate to and come from new information about the cognitive, affective, and physical functioning of the brain. Information on how the brain functions comes to the public in scientific, educational, and popular media. Brain-based learning principles relate very well to adult learning theory and composition theory, especially in the move from learning to learner-centeredness and active, experiential, and constructivist learning. Developmental English instructors can operate in a brain-based learning paradigm to a large degree by studying adult education and composition theorists.

The question remains whether brain-based principles are really different than current learning theory and if and how they can significantly improve education. The only aspects of brain-based learning strategies that did not overlap with composition and adult learning theory were the physiology of growing dendrites, brain plasticity, and response to stress. In fact, recent discoveries of the brain and mind are being successfully

applied to the classroom right now, one of which is the product FastForword developed by Dr. Michael Merzenich of Stanford and Dr. Paula Tallal of Rutgers (Jensen, n.d.). The program is in thousands of classrooms around the country, and "it specifically uses discoveries in neural plasticity to change the brain's ability to auditorally process the printed word" (Jensen, n.d., p. 8). Jensen notes that brain-based theory is not a magic bullet or panacea, nor should schools use biology as the only criteria for designing curriculum. However, brain research in learning can provide educators knowledge of why strategies work or don't work. Jensen says that knowing how the brain learns, educators "would be challenged by the prospect of changing student brains on a daily basis" (Jensen, n.d., p. 8).

Future Research Possibilities

The new paradigm calls for changes in the structure of education so that individual student differences can be met. This can mean changes differences in class and schedules and modes of delivery. For example at PPCC students can earn credits through distance education, independent study, classroom instruction, and internet classes. However, they still operate within the fifteen-week semester and three-hour-per-week course. Also, the nature of developmental studies as a preparation for college level work requires a level of mastery for students to attain before moving on.

Also, the emphasis on student outcomes can conflict with learner-centered, brain-based, and constructivist principles. With outcomes emphasis, especially when funding is attached, comes pressure for students to succeed in the school system as it exists. For community college developmental students, the challenge is going to be for those very

seriously deficient students who do not learn in the traditional way and on a traditional schedule (McCabe, 2000).

Further research will need to address learning needs of very underprepared students, whose numbers are growing. Perhaps brain-based principles can be of help. It would be beneficial to explore brain-based principles further to see if they can contribute to the education of nontraditional students more than adult educational and developmental educational theory does now. Research should address the best place for untraditional and seriously deficient students to obtain basic skills – GED programs or community college programs.

It is not clear how the paradigm shift to learner-centered education will manifest itself. Many have investigated methods of integrating it within the traditional college structure, and following the success of colleges doing so, such as Maricopa, will be useful.

Also, many brain-based principles are familiar to developmental English instructors through the venues of composition theory, developmental learning theory, and adult learning theory. Research should investigate application of the physiological brain properties such as plasticity, unconscious processing of information, and physiological requirements for learning such as rest and diet.

The building of schema is important, and Feuerstein (1980) and Merzenich (2000) have supposedly developed learning activities that encourage the growth of dendritic connections. Research in applying their work to community college students needs to be done.

Replication of This Study

Finally, if this study is to be replicated, the design needs to be tightened. Reliable measurements need to be selected and it would need to be made very clear to participants teaching one class in each group to include the brain-based lesson in only the class(es) in the brain-based group. Instructors visiting each other's classes could be made a priority, and that would be helpful. It would be helpful if instructors chose to include more than one brain-based lesson during the semester.

Also, the quantitative part of the study might obtain significant results with the choice of a class other than a composition class. Composition theory and instruction by its nature is aligned with brain-based theory. A better choice would be a class that is delivered primarily by lecture, such as a history class.

Another consideration that would improve the study would be a more time devoted to orientation to brain-based principles. The training in brain-based principles for this study consisted of discussing a list of brain-based principles with the instructors and relating the principles to what they already do. However, it was never clear to Bosco and Rufus how those principles differed from what they normally do when teaching. This made it difficult to come up with a brain-based lesson that was different from what they normally do. When Caine and Caine (1997) integrated brain-based principles in an elementary school and a middle school in California, orientation to brain-based learning consisted of having teachers read their book about brain-based learning, attend a two-day retreat, participate in group meetings every three or four weeks for three months, and attend a four-day workshop on brain-based learning. A future study like this would be better served with more in-depth training in brain-based principles. Rufus and Bosco delivered lessons using more visuals than usual, but they really did not have the benefit of

a thorough understanding of brain-based principles that went beyond those already found in composition theory.

This study would also be improved with selection of faculty participants who are already interested in brain-based principles. Rufus and Bosco might not have explored brain-based teaching strategies without incentive of this study, and it impacted the study in that they focused primarily on a commitment to their classes to a greater degree than exploring alternative delivery methods.

While there is no magic bullet that will solve the educational concerns of today, especially for adults who will need an education to survive in the information age, brain-based-learning may provide some answers in helping students become more self-directed and in helping faculty see ways to reach untraditional students.

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APPENDICES

APPENDIX A – COLORADO STATE UNIVERSITY

HUMAN SUBJECTS PROTOCOL FORM

Colorado State University Human Research Committee
Application to Use Human Subjects (H-100, Rev 10/2000)

Complete Part A and Part B. On separate pages, list all questions from Part C and respond to each as applicable. Part C should be replicated on your computer. For full review protocols, return the ORIGINAL (with original signatures) and 11 copies (each with all attachments except proposal/dissertation/thesis) to Regulatory Compliance, 410 University Services Center. Assistance is available on our web page at http://www.research.colostate.edu/regulatory/.

PART A. COVER SHEET

☒ New Protocol ☐ Resubmission

1. Project Title: Application of Brain-Based Learning Theory for Community College Developmental English students: A Case Study

2. Principal Investigator (PI): Robert W. Richburg, Ph.D. 3. Telephone: 970 491 6499
4. Department: School of Education 5. E-mail: Richburg@lamar.ColoState.edu
6. Co-Principal Investigator: Christine (Tina) Getz 7. Telephone: 719 540-7331
8. Department: N/A 9. E-mail: getz@ppac.cccoes.edu
10. If Co-PI is a student, is this project for a: ☐ Thesis ☒ Dissertation ☐ Neither
(Attach thesis/dissertation prospectus, abstract , or methodology chapter.)
11. Date project activity to begin: August 1, 2001
12. Will this project be supported by funds? ☐ Yes (answer 13-15) ☒ No (go to signatures)
13. Funding Agency (attach proposal or methodology section):
14. Grant/contract number:
15. Proposal deadline:

As the PI submitting this proposed research and signing below, I agree to conduct the research involving human subjects as presented in the protocol or modifications to it and as approved by the Department and the Human Research Committee; to obtain and document informed consent and provide a copy of the consent form to each subject unless this is waived by the HRC; to present any proposed modifications in the research to the HRC for review and approval prior to implementation; to retain records for the mandated lengths of time; and to report to the HRC any problems or injuries to subjects.

PI Signature: Robert W. Richburg Date: July 11, 2001

Department Chair/Head or Acting (circle which) Signature

My signature below confirms that I have read this protocol and approve of this research.

Signature: _____ Date: _____

APPENDIX B – PIKES PEAK COMMUNITY COLLEGE

PERMISSION TO USE SECONDARY RESEARCH

Pikes Peak
Community
College

Office of the President
5675 S. Academy Blvd., CC9
Colorado Springs, CO 80906

719.540.7551 tel
719.540.7016 fax
800.456.6847

www.ppcc.cccoes.edu

July 26, 2001

Ms. Tina Getz
2805 Sage Street
Colorado Springs, Colorado 80907

RE: Letter of Cooperation

Dear Ms. Getz:

Through Mr. Jeff Olson, executive director of Human Resources and Planning, you have asked that Pikes Peak Community College issue you a Letter of Cooperation so that you may conduct a mixed-method research project involving College faculty and students. I understand from Mr. Olson that you have provided him with copies of the communications fliers and informed consents you will use in your research, as well as a comprehensive explanation of how you intend to use them in your research. I further understand that this research project is in partial fulfillment of the requirements for the degree of Doctor of Philosophy from Colorado State University.

Based upon the information and documents you provided to Mr. Olson, and his review and approval of those submittals, I have concluded there is no-to-little risk to faculty and students by your research, and that the confidentiality of faculty and student participants ~~will~~ be maintained. Therefore, I am granting you access to three English 060 classes to conduct your research, as well as access to the gain scores from students' pre- and post-semester writing samples and attitude surveys in three classes of your choice during the Fall Semester 2001.

Best wishes on the successful completion of your research project.

Sincerely,

Joseph A. Garcia
President

c. HRS file

member of COMMUNITY COLLEGES OF COLORADO

APPENDIX C – RECRUITING FLIERS AND PUBLICITY

C-1 – *Recruiting script for general student participation*

NOTE: Class instructors will speak to their own classes, the DS English Department Chair or Dean of Developmental Studies will speak to my class.

Hello. My name is _____ and I'm here to invite you to participate in a study of instruction for English 060 classes. This semester the Developmental Studies English Department is collecting information on student improvement over the semester in English 060 classes at PPCC. In addition, Tina Getz is conducting research for her doctoral degree from Colorado State University. Your class has been selected as one of three to participate in her study.

For this study, I/your instructor will develop one or more lessons that we want to evaluate. The lessons will be only part of the classwork, and most of your instruction will be given in the usual way. The study will in no way interfere with the teaching of the class; in fact, we hope it can help make the class better. We hope that from this study we can improve our teaching of writing for this class.

You are not required to participate in the study, but if you agree to do so, your name will not be made available to graders for the study or anyone who reads the results of the study. At the end of the semester, we will be happy to share with you the method of instruction being studied as well as the results of the study.

There is no risk to you in participating in this study. Also, if you decide not to participate, it will not affect you in any way.

If you agree to participate in the study, please feel free to ask your instructor or myself if you have any questions or reservations. Also, at any time during the semester you may request that information from your pre and post test writing sample and survey be withheld from the study.

Please read the consent form I have handed out and sign if you agree to help us. If you are under the age of 18, a parent or legal guardian needs to sign as well.

Do you have any questions about the study or your participation in it?

Thank you for your help with this study.

In addition to the class participation, we are looking for up to four people in each class whom we can interview three times over the semester. I am also handing out a flier describing what that would involve and how to sign up for that.

C-2 – *Flier to Recruit Students for Interviews*

NOTE: This was distributed to students in the first week of classes.

We are looking for four student volunteers from your English 060 class to help with Tina Getz's doctoral study through Colorado State University. The study will attempt to discover what happens in English 060 over the course of a semester from the student perspective. If you agree to help us, we will interview you three times over the semester about how you think the class is going, what is working, what you think of the instructional methods, and so on. We anticipate each interview will take 10 to 20 minutes. At the conclusion of the third interview you will receive $15 for helping us with all three interviews.

You need to be over 18 years old to participate in the interviews, and you need to have time to be interviewed three times over the semester outside of class time and be motivated to complete the semester. The interviews will each last from 10 to 20 minutes. They will be about teaching methods for English 060; they will not ask for any personal information. Your name will be kept confidential; in fact, we don't want your instructor to know who is participating in the interviews, so you also need to be able to keep that a secret until grades are turned in at the end of the semester.

The interviews will be tape recorded and transcribed.

If you are interested in helping us with the interviews, please contact _____ with the Peer Tutoring Program, 540-7128. He/she will be the person who will do the interviewing for this study, and he will select students to be interviewed.

There is no risk involved with participating in the interview part of this study. Also, if you agree to help us with the interviews but decide you don't want to continue or don't want us to use the information, you are free to withdraw from the study or strike any information for a particular interview.

If you have any questions about the study, please contact Tina Getz, room F 246, 540-7331 of Jo Berger, room F245, 540-7320.

Thank you for considering helping us in this way.

In addition to the class participation, we are looking for up to four people in each class whom we can interview three times over the semester. I am also handing out a flier describing what that would involve and how to sign up for that.

C – 3 Cover *Letter to instructor*:

NOTE: This was sent on PPCC Letterhead.

Dear _____,

This semester Tina Getz will be conducting a study of teaching methods for English 060 through Colorado State University. She is looking for two instructors who would like to join her in investigating the efficacy of applying principles a learning theory to a lesson or unit in their English 060 class at Centennial Campus.

The enclosed flier explains what would be involved in the study. If you are interested in learning more about the proposed study and Tina's research, please call either her or myself (540-7333) or Jo Berger (540-7320).

Sandra Miller
DS English Department Chair

C-4 *Flier to recruit English 060 instructors*
NOTE: This flier WAS delivered to faculty teaching English 060 in the Fall of 2001. It will be sent through campus mail or US Mail the first week of August, 2001

I am writing to enlist your participation in my doctoral study through Colorado State University for Fall Semester 2001. In my study I will be exploring the applicability of brain-based teaching for English 060 students. Obviously, all learning is "brain based," but for my study the term relates to the growing body of literature about structuring educational activities according to what current research says about the brain's natural way of processing information.

The purpose of this research is to discover whether or not a focused delivery of brain-based instructional elements for English 060 classes facilitates student attention, motivation, and learning. The questions I am hoping to answer include

(1) How can instruction for developmental English classes be designed according to the concepts of brain-based theory?
(2) How would students and faculty respond to that instruction?
(3) Would faculty perceive that brain-based instruction differs significantly from other instructional models using similar delivery methods (ie group work, considering learning styles, and so on)?

Agreement to participate in this study means that you will identify a lesson or unit you would like to improve and allow me to help you develop that unit or lesson for one of your English 060 classes for Fall Semester 2001 using brain-based concepts and that you share with me your thoughts on the effectiveness of the lesson or unit in a journal written after delivery of the lesson/unit and through three audio-taped interviews during the semester. I would like to allow for the option of the three instructors visiting each other's class if we so desire. No one would visit another class without that instructor's permission. I estimate that participating in this study will take up to eight hours of your time over the semester.

The first of the three interviews will occur during the two weeks before classes begin and explore your thoughts about the strengths and challenges of teaching English 060 and help identify the topic for the lesson you would like to deliver. The second will occur after your deliver the unit, and the third at the end of the semester. Your interviews will be transcribed and coded for analysis, and I will ask that you review my analysis for accuracy.

The design of your unit of instruction would include activities to engage the student's interest and emotion in the topic, elicit the student's current understanding of the topic, provide opportunity for nonthreatening practice and opportunity to make and correct errors relating to the topic. The instruction will also include use of multi media, individual and group work, student feedback, and perhaps individual activities to supplement instruction. While I will suggest activities, the development of the unit should be entirely yours. Ideally the lesson will be delivered in the first 3 to 5 weeks of the semester, and if you like, we can work together to develop subsequent lessons or units

using the concepts of brain-based learning. There is also an opportunity for the three instructors in the study to visit each other's classes if they desire.

I will also request your consent to involve students in your class on two levels. First, I would like to compare their gain scores on the pre and post semester writing samples and attitude towards writing surveys to those collected from other classes for institutional research. Second, for this study up to four students from each of the three classes involved in the study will be interviewed by a student peer tutor at the beginning and end of the semester as well as within a week of your delivery of the brain-based lesson/unit. I request that you discuss the study with your class, pass out fliers telling students how to contact the peer tutor who will be selecting the students and interviewing them, and give students consent forms to sign for the study.

The identities of the students being interviewed should not be known to you so that no one will have a concern that those students' grades were affected positively or negatively because of their participation in the study. The students will have to sign a consent form, and I ask that you tell them that we will be studying a type of instruction, but they will not know what that is until the end of the semester. They should not know which part of your instruction is the brain-based unit or lesson until the end of the semester. When I analyze the student interviews, I want to see if any of their comments tie in to brain-based theory and especially if they volunteer any feedback on the brain-based lesson.

Your identity as well as that of all students involved in the study will be kept confidential. If you agree to participate in this study and change your mind, you may withdraw at any time with no negative effect.

Please call me or stop by my office if you are interested in participating in this study or if you have any questions about the study.

Tina Getz
Home – 635-7265
Work 540-7331

APPENDIX D – INFORMED CONSENT TO PARTICIPATE IN A RESEARCH PROJECT

D-1 *Consent form to use gain score in pre and post semester writing samples and attitude surveys for students in the three classes:*

COLORADO STATE UNIVERSITY

INFORMED CONSENT TO PARTICIPATE IN A RESEARCH PROJECT

TITLE OF THE PROJECT: Application of Brain-Based Learning Theory for Community College Developmental English Students: A Case Study.

NAME OF PRINCIPAL INVESTIGATOR: Dr. Robert Richburg, Colorado State University, Fort Collins, CO.

NAME OF CO-INVESTIGATOR: Tina Getz, Pikes Peak Community College, Colorado Springs, CO

CONTACT NAME AND PHONE NUMBER FOR QUESTIONS/PROBLEMS:
Dr. Jo Berger, Dean of Developmental Studies, 540-7320

PURPOSE OF RESEARCH: This study involves research with students to learn from them what they think happens in English 060 – how helpful you find the class, what you think you actually learn over a semester, and what could improve it. We will also be investigating a teaching strategy that will be disclosed to students at the end of the semester.

PROCEDURES/METHODS USED: We are asking that you give us permission to include your gain score from the pre and post semester writing samples and attitude surveys.

RISKS INHERENT IN THE PROCEDURES: There is no reason to believe that this study raises physical or emotional risk. Every effort will be made to protect your confidentiality.

It is not possible to identify all potential risks in research procedures, but the researchers have taken reasonable safeguards to minimize any known and potential, but unknown, risks.

BENEFITS: The benefit to you will be the knowledge that you helped us learn more about English 060 from the perspective of students.

Page 1 of 2 Participant's initials ____ Date_____

CONFIDENTIALITY: At no time will your real name be used in this study, nor will your course section number. You may choose a pseudonym for your writing sample and attitude survey. Also, we will not list individual gain scores, but use the total score for the class. Additionally, the real class section number will not be used for the study.

LIABILITY: The Colorado Governmental Immunity Act determines and may limit Colorado State University's legal responsibility if an injury happens because of this study. Claims against the University must be filed within 180 days of the injury.

Questions about participants' rights may be directed to Celia S. Walker at (970) 491-1563.

PARTICIPATION: Your participation in this research is voluntary. If you decide to participate in the study, you may withdraw your consent and stop participating at any time without penalty or loss of benefits to which you are otherwise entitled.

Your signature acknowledges that you have read the information and stated and willingly signed this consent form. Your signature also acknowledges that you have received, on the date signed, a copy of this document containing 2 pages.

_____
Participant Name

_____ _____
Participant Signature Date

_____ _____
Witness to signature (project staff) Date

PARENTAL SIGNATURE FOR MINOR

As parent or guardian you authorize_____(print name) to become a participant for the described research. The nature and general purpose of the project have been satisfactorily explained to you by _____ and you are satisfied that proper precautions will be observed.

_____
Minor's date of birth

_____
Parent/Guardian (printed)

_____ _____
Parent/Guardian signature Date

D-2 *Consent for up to twelve English 060 students to participate in taped interviews.*

COLORADO STATE UNIVERSITY

INFORMED CONSENTE TO PARTICIPATE INA RESEARCH PROJECT

TITLE OF THE PROJECT: Application of Brain-Based Learning Theory for Community
College Developmental English Students: A Case Study.

NAME OF PRINCIPAL INVESTIGATOR: Dr. Robert Richburg, Colorado State University, Fort Collins, CO.

NAME OF CO-INVESTIGATOR: Tina Getz, Pikes Peak Community College, Colorado Springs, CO

CONTACT NAME AND PHONE NUMBER FOR QUESTIONS/PROBLEMS:
Dr. Jo Berger, Dean of Developmental Studies, 540-7320

PURPOSE OF RESEARCH: This study involves research with students to learn from them what they think happens in English 060 – how helpful you find the class, what you think you actually learn over a semester, and what could improve it. We will also be investigating a teaching strategy that will be disclosed to students at the end of the semester.

PROCEDURES/METHODS USED: As a participant in this study you will need to be interviewed with a tape recorder three times during the semester – once at the beginning, once at the end, and once in between.

RISKS INHERENT IN THE PROCEDURES: There is no reason to believe that this study raises physical or emotional stress. Every effort will be made to protect your confidentiality.

It is not possible to identify all potential risks in research procedures, but the researchers have taken reasonable safeguards to minimize any known and potential, but unknown, risks.

BENEFITS: The benefit to you will be the knowledge that you helped us learn more about English 060 from the perspective of students.

Page 1 of 2 Participant's initials ____ Date_____

CONFIDENTIALITY: At no time will your real name be used in this study, nor will your course section number. You may choose a pseudonym for your taped interviews. Also, the transcripts and analyses of your interviews will use your pseudonym. The tapes will be destroyed after they are transcribed and analyzed. The transcripts and analyses will be held for three years in a locked file cabinet, after which time they will be destroyed. The information obtained from your interviews will not be distributed other than in the dissertation.

LIABILITY: The Colorado Governmental Immunity Act determines and may limit Colorado State University's legal responsibility if an injury happens because of this study. Claims against the University must be filed within 180 days of the injury.

Questions about participants' rights may be directed to Celia S. Walker at (970) 491-1563.

PARTICIPATION: Your participation in this research is voluntary. If you decide to participate in the study, you may withdraw your consent and stop participating at any time without penalty or loss of benefits to which you are otherwise entitled.

Your signature acknowledges that you have read the information and stated and willingly signed this consent form. Your signature also acknowledges that you have received, on the date signed, a copy of this document containing 2 pages.

_____
Participant Name

_____ _____
Participant Signature Date

_____ _____
Witness to signature (project staff) Date

D-3: *Consent form for faculty.*

COLORADO STATE UNIVERSITY

INFORMED CONSENT TO PARTICIPATE IN A RESEARCH PROJECT

TITLE OF THE PROJECT: Application of Brain-Based Learning Theory for Community College Developmental English Students: A Case Study..

NAME OF PRINCIPAL INVESTIGATOR: Dr. Robert Richburg, Colorado State University, Fort Collins, CO.

NAME OF CO-INVESTIGATOR: Tina Getz, Pikes Peak Community College, Colorado Springs, CO

CONTACT NAME AND PHONE NUMBER FOR QUESTIONS/PROBLEMS: Dr. Jo Berger, Dean of Developmental Studies, 540-7320

PURPOSE OF RESEARCH: This study involves research with faculty regarding application of brain-based lessons/activities for English 060 students: how it can be developed, evaluating its success.

PROCEDURES/METHODS USED: Your participation in this study will mean

(1) spending time developing a brain-based lesson/unit/activity for one of your English
060 classes for Fall 2001,
(2) being interviewed three times during the semester on audio tape,
(3) writing a reflective journal following delivery of your brain-based lesson/activity/unit,
(4) consenting to use the gain scores from the pre and post semester writing sample and attitude survey for the Eng 060 class identified for this study, and
(5) consenting that up to 4 of the English 060 students from the class identified for this study (and whose identities are not known to you) be interviewed regarding instructional methods three times during the semester.

RISKS INHERENT IN THE PROCEDURES: There is no reason to believe that this study poses physical or emotional stress. It is not possible to identify all potential risks in research procedures, but the researchers have taken reasonable safeguards to minimize any known and potential, but unknown, risks.

BENEFITS: The benefit to you will be the result of curriculum developed for this study.

CONFIDENTIALITY: At no time will your real name be used in this study, nor will your course section number. You may choose a pseudonym for your taped interviews

Page 1 of 2 Participant's initials ____ Date_____

and reflective journals. Also, the transcripts and analyses of your interviews will use your pseudonym. The tapes will be destroyed after they are transcribed. Transcriptions and analyses of the tapes will held for three years in a locked file cabinet, after which time they will be destroyed. The information obtained from all interviews and your reflective journal will remain with the study and not be distributed otherwise.

LIABILITY: The Colorado Governmental Immunity Act determines and may limit Colorado State University's legal responsibility if an injury happens because of this study. Claims against the University must be filed within 180 days of the injury.

Questions about participants' rights may be directed to Celia S. Walker at (970) 491-1563.

PARTICIPATION: Your participation in this research is voluntary. If you decide to participate in the study, you may withdraw your consent and stop participating at any time without penalty or loss of benefits to which you are otherwise entitled.

Your signature acknowledges that you have read the information and stated and willingly signed this consent form. Your signature also acknowledges that you have received, on the date signed, a copy of this document containing 2 pages.

_____
Participant Name

_____ _____
Participant Signature Date

_____ _____
Witness to signature (project staff) Date

APPENDIX E – ATTITUDE TOWARD WRITING SURVEYS

Attitude Toward Writing Survey

Part II: Indicate how much you agree or disagree with the statements listed below.

	Strongly Disagree				Strongly Agree
1. Good teachers can help me become a better writer	1	2	3	4	5
2. Good writers are born, not made.	1	2	3	4	5
3. Some people have said, "Writing can be learned, but it can't be taught." Do you believe it can be learned?	1	2	3	4	5
4. Some people have said, "Writing can be learned, but it can't be taught." Do you believe writing can be taught?	1	2	3	4	5
5. I avoid writing.	1	2	3	4	5
6. I enjoy writing.	1	2	3	4	5
7. Discussing my writing with others is an enjoyable experience.	1	2	3	4	5
8. Writing is a lot of fun.	1	2	3	4	5
9. I'm no good at writing	1	2	3	4	5
10. I am a good writer.	1	2	3	3	5
11. I have always been a good writer.	1	2	3	4	5
12. I believe I was born with the ability to write.	1	2	3	4	5

Part II. Indicate how easy or hard the following writing tasks are for you.

	Very Hard			Very Easy
1. Coming up with ideas	1	2	3	4
2. Writing good-sounding sentences	1	2	3	4
3. Organizing a paragraph	1	2	3	4
4. Adding the right amount of detail	1	2	3	4
5. Spelling and grammar	1	2	3	4
6. Finding enough to say	1	2	3	4
7. Sticking to the subject	1	2	3	4
8. Knowing what the instructor wants	1	2	3	4
9. Understanding the main idea of a reading assignment	1	2	3	4

APPENDIX F – GRADING RUBRIC FOR WRITING SAMPLE

Grading for English 060 Writing Samples

This rubric addresses our major concerns for English 060 paragraphs. Each of the four sections is assigned a point value. After reading the paper, give each section a score based on your overall evaluation of that section, with the idea that a maximum score for a section would represent a perfect 060 paper.

5 Purpose _____

Introduction engages audience interest
Purpose is clear
Point of view is consistent
Consideration of audience is apparent
Thoughtful, mature response to prompt

7 Development _____

Topic sentence has subject, controlling idea
All main points and details support topic sentence
Conclusion connects with the topic sentence
Topic is adequately and clearly supported
Supporting points are well thought out and balanced
Organization is clear
Coherence devices, including transitions, used successfully

3 Style _____

Lively, interesting, varied vocabulary
Manuscript format is correct
Writer's unique voice comes through
Writer's tone is apparent

5 Conventions/Mechanics _____

Sentence structure is sound and varied
Writer shows mastery of major sentence skills
Writer shows mastery of grammar/mechanical skills
Few spelling errors

20 _____

Major sentence errors include run-ons, comma splices, fragments, subject/verb agreement.

Grammar/mechanical skills include pronoun usage, comma usage, apostrophe usage, capitalization

APPENDIX G – STUDENT AND FACULTY

INTERVIEW QUESTIONS

G– *1 Student Interviews:*
NOTE: In the spirit of qualitative research, the interviewer was instructed that he could add or delete questions during the actual interview.

First Interview to occur the first two weeks of the semester:

Briefing at beginning of the interview:
1. Thank student for participating in the study.
2. Student gives a code name that you know, but I don't know.
3. Explain about the tape recorder.
4. Explain that the student can stop the interview at any time and for any reason and that the interviewer will stop the interview in the unlikely event that the student appears upset for any reason.

Debriefing at the end of each interview:
1. Thank the student for his or her time and input.
2. Review main points of the interview.
3. Turn off the tape recorder.
4. Ask if the student would like to add anything.
5. As if the student would like to strike any information from the transcript of the tape. If so, the interview should make a note so the transcriber knows to not include that information.

QUESTIONS:

Interviewer says the following: "The purpose of this interview is to learn a little about you and how you feel about college, writing in general, and your writing class."

a. Is this your first semester at PPCC?
b. How many credits are you carrying?
c. Why did you decide to continue your education?
d. What would you say are your writing strengths and weaknesses?
e. Considering your past experiences in writing, what do you think will go well for you in this class?
f. In general, how would you describe the kind of instruction that is effective for you?
g. What changes do you expect to see in your writing as a result of this class?
h. How important is a writing class for college students?
i. Is there anything else you'd like to add?

Second interview after brain-based lesson:
Interviewer says the following: "The purpose of this interview is to see how things are going up to this point and to hear from you the things that have worked well in this class."

a. How is your writing class going at this point?
b. In what ways is it like what you expected and in what ways is it different?
c. How effective is the instruction (book, worksheets & activities, lectures, etc.) for you?
d. Can you think of a class/lesson that you think went especially well for you? If so, please describe that class and tell what worked well.
e. Are you encountering the same writing struggles you mentioned in the last interview? Please explain, and if you can, tell what you think could help you overcome those struggles.
f. What would you say you've learned so far in this class? Do you see what you've learned as helpful to your future studies/work? If so, how?
g. Is there anything else you'd like to add?

Third interview – at the end of the semester:
Interviewer says the following: "The purpose of this interview is to learn from your perspective the overall success of this class for you."

a. Now that the semester is about over, did this class do for you what you hoped?
b. Has your writing and/or writing confidence changed? If so, how?
c. Describe some really good classes in this class over the semester.
d. Describe some classes that didn't do much for you this semester.
e. Would you recommend this class to others? Why or why not?
f. Is there anything else you'd like to add?

G-2 Faculty Interviews:

Briefing and Debriefing

Briefing at beginning of the interview:

1. Thank instructor for participating in the study.
2. Instructor gives a code name for the interviews.
3. Explain about the tape recorder.
4. Explain that the instructor can stop the interview at any time and for any reason and that the interviewer will stop the interview in the unlikely event that the instructor appears upset for any reason.

Debriefing at the end of each interview:

1. Thank the instructor for his or her time and input.
2. Review main points of the interview.
3. Turn off the tape recorder.
4. Ask if the instructor would like to add anything.
5. As if the instructor would like to strike any information from the transcript of the tape. If so, the interview should make a note so the transcriber knows to not include that information.

After the information from each interview is transcribed and coded, ask instructor to review it for content and accuracy.

Interviews Questions:

First Interview: Interviewer starts off by saying, " The first interview will be designed to discover an area to which instructors want to apply brain-based learning."

Questions:

1. What led you to teaching DS English?
2. What do you like about working with DS English students?
3. Describe the developmental student
4. What does Eng 060 have to offer the developmental students
5. What really works well in Engl 060 for ds students
6. What are some of the challenges of Engl 060
7. What have you tried to address these challenges
8. If there is one part of 060 that you would like to work on, what would it be?
9. What have you tried in the past regarding this specific concern?
10. What specifically would you like to see improved about that part?

After developing and teaching the lesson:

1. How do you feel the lesson went?
2. How would you assess its success with students?
3. When you went in to teach the lesson, what did you expect?

4. Were your expectations met? Not met? Exceeded?
5. How would you compare this method to others you've tried in the past?
6. Do you see opportunities to incorporate any of the activities from brain-based theory to future lessons? Would you want to?
7. What worked well?
8. What didn't?
9. What would you change next time?

At the end of the semester

1. How did the semester go for you with this class?
2. On (first interview date) you said that the usual challenges for students taking English 060 include _____. Did you experience those challenges this semester?
3. How did the brain-based lesson contribute to students' learning this semester? Was it as effective as other methods?
4. Would you want to develop a brain-based lesson in the future? If so, how could you see yourself incorporating brain-based concepts in future instructional units?
5. Was there anything in the brain-based lesson that changed how you see your students' learning?

APPENDIX H – CODING OF TRANSCRIPTS

A colleague and I met to begin coding the transcripts. She was experienced in coding from when she wrote her dissertation. We used the sentence as a unit of measurement, and in the margin of the text we identified major categories identified with student learning/success along with assigning a number to specific elements within categories. Each new element that was selected was also assigned a chronological number, which I later called the "data bit" number. For example, when Bosco said, "I think it works well in English 060 to never lecture more than 15 to 20 minutes at a time," we wrote in the margin L (our code for the learning process) and a number (3) because this was the third item we identified relating to the learning process, and the word "lecture" for the specific subcategory under "learning process." That sentence was assigned the data bit number 9 because it was the ninth sentence identified in our coding.

We began by discussing the first five interviews to come to consensus on the categories and elements within the categories. Then we coded the remaining four interviews individually, comparing notes after each interview. We achieved an agreement rate of .8 by discussing the categories we found, adjusting to be most inclusive of the categories and elements, and finding that we identified the same categories and elements on the initial individual coding for 80% of the identified categories and elements. Four categories emerged from our initial coding: Outcome of learning (O), Student characteristics (S), Instructor Characteristics (I), and the Learning Process (L).

After coding with my colleague, I reread the transcripts several times and added additional categories and elements within categories. As a result, I added the new categories of the Writing Process (WP) and Administrative Constraints (A).

I then organized the responses into a four-column chart which listed the following for each: the data bit number, the source (which includes the question, the name of the interviewee, and the location in the transcript), the direct quote for the answer (which often included multiple related sentences), and the coded elements and linkages. An example of the chart is shown below:

Bit #	Source	Sentence(s)	Code
9	Bosco, Interview 1, p. 12, lines 11-13 Prompt: (cont'd) What works well For Eng 060 students?	I think it works well in Eng 060 to never lecture or talk more than 15 or or 20 minutes. And then to have students respond back either in terms of a focused freewrite of "what did I hear you say?" or questions or summaries of what they just thought they heard.	P3 – Lecture, notetaking P4- focused freewrite P5 – questioning P25 – summarize Links: P4 assoc with P5 & P25 P3 needs to be limited

In order to collect responses of faculty according to category, I mad ten-column charts for each of the categories. The first column listed the coded elements, such a "lecture/notetaking," and nine columns that followed were for each of the three interviews of the instructors. In each of those columns I listed the data bit number for a response corresponding to that element. Each row was divided in half with faculty responses going in the top half and student responses going in the bottom half. Negative references were underlined. Faculty journal responses were included in the last column with a prefix J. An example of the chart follows:

Learning Process (L) Code Word	Bosco			Rufus			Tina		
L3-Lecture/ Notetaking	Int 1	Int 2	Int 3	Int 1	Int 2	Int 3	Int 1	Int 2	Int 3
Instructor	9,11,13	26,31,33, 34,41,44	90	123	137		193,195	207,209 210	219
Student	99	105	90	150			242		

(Note: Underline with a data bit # indicates a negative response.)

This chart allowed me to see easily that instructors mentioned lecture/notetaking 17 times (9 of which were negative references) while students only mentioned lecture/notetaking 5 times (2 of which were negative references).

In order to further refine my lists of categories and elements, I organized the individual elements into subcategories with the number of faculty and student responses for each. The result for the Learning Process category is presented in Table 16:

Table 16

Learning Process

Traditional-Behaviorist				**Make connections**			
LP-1	**Formula learning**	**F=6**	**St=2**	**LP-10**	**Relate classwrk to stu exp**	**F=15**	**St=5**
LP-20	**Worksheets**	**F=4**	**St=2**	**LP-17**	**Relevant examples**	**F-4**	**St=1**
LP-25	**Practice**	**F=5**	**St=3**	**LP-24**	**have students make connections**	**F-12**	**St=1**
LP-34	**Effort-time**	**F=2**	**St=5**	**LP-30**	**Provice background/context/info**	**F15**	**St=1**
LP-2	**Concept meth**	**F=10**	**St=3**				
LP-3	**Lecture/notetaking**	**F=18**	**St=8**	**Using Writing in Learning Process**			
LP-27	**Instructor explanation**	**F=0**	**St=12**	**LP-4**	**Focused freewrite**	**F=7**	**St=0**
LP-32	**Model examples**	**F=3**	**St=4**	**LP=25**	**Have students summarize**	**F=2**	**St=0**
LP-14	**Class discussion**	**F=24**	**St=1**				
LP-36	**Memorize (negative comment)**	**F=0**	**St=1**	**Emotional**			
LP-37	**Task is clear**	**F=3**	**St=3**	**LP-8**	**Emotional support**	**F=5**	**St=0**
LP-39	**Give feedback**	**F=3**	**St=1**	**LP-22**	**Create the unexpected**	**F=5**	**St=0**

LP-43	Grades	F=1	St=1	LP-23	Humor	F=1	St=1
LP-44	Bonus points	F=4	St=0	LP-35	Create successful exp	F=3	St=1
LP-49	Homework	F=1	St=6	LP-47-	Make class fun	F=3	St=2
LP-51	Textbook (didn't like)	F=0	St=7				
					Organizational		
Cognitive				LP-21	Syllabus	F=2	St=2
LP-9	Divide Tasks to mngeale prts	F=3	St=2	LP=52	Pace of class	F=0	St=1
LP-11	Threading	F=6	St=0	LP-55	Inconsistent methods	F=1	St=1
LP-35	Create successful exp	F=3	St=1				
LP-50	Easy tasks	F=1	St=2	LP-31	Experiment	F-0	St=1
	Seamless	F=6	St=0	LP-12	Hands-on	F=0	St=5
rom stu char - st=3)							
LP-57	solicit student feedback	F=2	St=1	Learning Style			
				LP-13	Visual	F=27	St=1
Constructivist				(from stu char –st= 5)			
LP-5	Questioning	F=14	St=2	LP-6	Vary instr methods	F=8	St=1
LP-45	Elicit info from student	F=6	St=0	LP-41	Use of color	F-2	St=0
LP-15	Reading class material	F=10	St=0	LP-48	Teach learning strategies	F=9	St=4
LP-16	Repetition	F-2	St=5				
LP-19	Present challenges	F=11	St=1				
LP-22	create the unexpected	F=5	St=0	This gave me a sense of how the concepts related to other			
LP-60	Make each class count	F=1	St=1	learning theories covered in my literature review and how			
LP-59	Computer	F=0	St=4	much they came from faculty and students.			
LP-54	Student helps design instr	F=1	St=0				
Collaborative							
LP-8	Individual attention	F=3	St=4				
LP-58	Stu/ instr work tog to slv prob	F-1	St=0				
LP-18	Small groups	F=9	St=0				
Stories							
SL-33	Stories	F=3	St=1				

APPENDIX I – COMPARISON OF STUDENT INTERVIEWS WITH SURVEY RESPONSES FOR TRIANGULATION

Comparison of Student Interviews and Surveys

On the whole, but with some exceptions, student interviews supported their responses on the surveys and their reported improvement in writing as measured by the Writing Sample.

Pluto. In the first interview Pluto said that English confused her, she hated reading unless the subject interested her, and she needed to know "more stuff" in order to improve. In her second and third interview she said she understood the writing concepts better, could brainstorm easier, and felt she was a better writer. She did not complete a final writing sample in time for it to be graded, so there is no gain score to substantiate her perceived improvement in writing. However, on the surveys from pre to post test she rated herself higher as being a good writer, in having always been a good writer, in coming up with ideas, writing good-sounding sentences, organizing a paragraph, and grammar and spelling.

Chipmunk. Chipmunk showed some discrepancy between what she said during the interview and what she reported on the surveys. In the first interview she said that her strength was in coming up with ideas and her weakness was organization. However, on the pretest survey she rated coming up with ideas and organizing a paragraph as equally difficult (2 out of 4 with 1 being very hard and 4 being very easy). In the second interview she said she was always good with grammar and spelling, and in both the pre and post surveys she confirmed that by ranking "spelling and grammar" with a 4 (very easy). Chipmunk improved only 2.8 points (out of 40 possible) for the Writing Sample, and she scored lower on posttests for both the Attitude toward Writing and Comfort with Writing Surveys.

Ryoga. In the first interview Ryoga referred to a "wall" that blocked her writing, but by the end of the semester she reported that she wrote an A paper that wasn't hampered by the "wall" by first freewriting, then rewriting and organizing. In her first interview she said that English was her worst subject and she wanted to work on punctuation and sentence structure. By the end of the semester, Ryoga said that she had improved in all areas, including organization. Her pre and post semester survey scores reflect what she said in the interviews – she raised her scores for enjoying writing (from 1 to 3), being a good writing (2 to 3), writing good sounding sentences (1 to 3), organizing a paragraph (1-3), adding the right amount of detail (1-3), spelling and grammar (1-2) finding enough to say (1-2), sticking to the subject (1-3), and understanding the main idea of a reading (1-2). Ryoga's Writing Sample score, however, was exactly the same from beginning of the semester and end of the semester.

Princess. Princess reported in her first interview that it was easy to come up with ideas, but that punctuation, sentence structure, grammar and spelling were concerns. She reported in the second and third interview that she thought she was improving in sentence structure and doing better than she thought she would. Her Writing Sample indeed showed an increase from 15.5 to 28.5. In the attitude toward writing survey, Princess raised her score three points, one each for three questions related to believing she is a good writer; however her she dropped one point from 48 to 47 on the entire survey. Her Comfort with the Writing Situation Survey increase 2 points from 25 to 27 with differences in pre to post survey in coming up with ideas (down 1 point), sticking to the subject (up 1 point), and understanding what the instructor wants (up 2 points); she gave

rated spelling and grammar exactly the same (2 out of 4, with 4 being most difficult) in both the pre and post survey.

Phil. In his first interview Phil reported he had good ideas, but that he needed to strengthen sentence punctuation, flow, and getting his ideas on paper. In the second and third interviews he reported that he was learning about sentence structure and that his writing skill in general had improved. His improvement from 13.5 to 27 on the Writing Sample supports this statement; interestingly, he scored the same in pre and post writing samples in convention and mechanics, making his improvement in scores for purpose, development, and style. Phil improved 3 points in the Attitude toward Writing Survey and 2 points in the Comfort with the Writing Situation Survey. Confirming his report of improving in sentence structure and general writing, in his post survey on Comfort with the Writing Situation, he said that writing good sentences, organizing a paragraph, and spelling and grammar were easier.

Oh Three. Oh Three only completed two interviews. In the first interview, he said that his strengths were in writing from experience and his weakness is trying to write about something he had no background in. In his second interview he said that he had improved in being able to generate ideas and organize his thoughts on paper. Oh Three brought his initial score of 19 on the Writing Sample up to 30 on the post semester Writing Sample. He increased his Attitude toward Writing Survey score by 3 points on two statements regarding confidence in writing, and scored exactly the same and the pre and post Comfort with the Writing Situation.

APPENDIX J – EMERGENT THEMES

Student Characteristics

	Faculty Comments	Student Comments
Academic History		
S-1 Academic experience	F=7	St=0
S-23 – frustrated by educational setting	F=0	St=0
S-40 – make mistakes	F=0	St=1 (still makes mistakes)
S-44 - Trust teachers/ed system	F=1	St=0
S-46 – Out of school for a while	F=3	St=3
S-65 - Recent HS Grad	F-3	St-0
Personality		
S-2 – without artifice	F=1	St = 0
S-3 – Passive	F=5	St = 0
S-8 – helpful	F=0	St=0
S-16 – Maturity	F=3	St=0
S-53 – accept challenges	F=1	St=0
S-54 – willing to take risks	F=1	St=0
S-21 – challenging	F=3	St=0
Emotion		
S-4 – Fear and Anxiety	F=1	St=2
S-52 – comfortable, not threatened	F=2	St=1
S-22 – angry	F=1	St=0
Learning Style		
S-10 – visual learner	F=0	St=5
S-11 – Hands-on	F=0	St=3
S-42 – verbal ability	F=0	St=1
Motivation		
S-5 Determination/Motivation	F-5	St-1
S-39 – Motivated	F=3	St=0
S-45 – work hard	F=1	St=0
S-48 – independent learner	F=3	St=0
S-30 – Lazy	F=0	St=1 (why stu leave)
S-55 – (poor) attendance	F=5	St=1 (why stu leave)
S57 – (doesn't) keep up with HW	F=1	St=0
Engagement		
S-3- Passive	F=5	St = 0
S-56 – active learner	F=2	St=0
S-64 - Attentive	F=4	St=0
S-6 – Receptive	F=2	St=1
S-26 – Resist learning	F=2	St=0
S-20 – enthusiastic/interested/ involved/engaged	F=19	St=5
S-61 – Gets bored	F-0	St=1
S-60- Confused	F=0	St=5
Disposition towards writing		
S-9 – Writer's Block	F=0	St=1
S-34 – Poor writer	F=1	St=3

Student characteristics page 2

Characteristics		
S-13 – Working class background	F=6	St=0
S-14 – Age Diversity	F=1	St=0
S-15 – Disabled	F=1	St=0
S-18 – Second language student	F=4	St=0
S-36 – Diverse	F=2	St=0
S-38 – Best of buddies	F=1	St=0
S-46 – Out of school for a while	F=3	St=3
Life Events		
S-17 – Disruption	F=1	St=0
S-29 – Personal problems, Complicated lives	F=4	St=2 (explain why students leave)
S-32 – children gone	F=1	St=0
S-33 – Laid off	F=1	St=0
S-62 - Wants new start	F=0	St=1
Physical needs		
S 25 – Sleepy	F=3	St=1
S-63 - Hungry	F=1	St=0
Result		
S-27 – No longer struggled	F=0	St=4
S-7 – Confident	F=3	St=15
Facility with Learning		
S-49 – significant learning concerns	F=1	St=0
S-24 – Inconsistent	F=5	St=0
S-37 – Quick to get it	F-2	St=0
S-35 – capable students	F=3	St=0
Barriers		
S-41 – superficial thinking	F=5	St=0
S-50 (not) open mind	F=1	St=0
Student Strengths		
S-19 – responsible for own learning	F=5	S=1
S-28 - Set goals	F=0	St=1
S-47 – Diligent	F=1	St=0
S-43 – perserverance	F=3	St=2
S-51 – see other perspectives	F=2	St=1
S-59 Organizes time well	F=0	St=1

Learning Process

Traditional-Behaviorist				
LP-1	Formula learning	F=6	St=2	
LP-20	Worksheets	F=4	St=2	
LP-25	Practice	F=5	St=3	
LP-34	Effort-time	F=2	St=5	
LP-2	Concept meth	F=10	St=3	
LP-3	Lecture/notetaking	F=18	St=8	
LP-27	Instructor explanation	F=0	St=12	
LP-32	Model examples	F=3	St=4	
LP-14	Class discussion	F=24	St=1	
LP-36	Memorize (negative comment)	F=0	St=1	
LP-37	Task is clear	F=3	St=3	
LP-39	Give feedback	F=3	St=1	
LP-43	Grades	F=1	St=1	
LP-44	Bonus points	F=4	St=0	
LP-49	Homework	F=1	St=6	
LP-51	Textbook (didn't like)	F=0	St=7	
Cognitive				
LP-9	Divide Tasks into manageable parts	F=3	St=2	
LP-11	Threading	F=6	St=0	
LP-35	Create successful exp	F=3	St=1	
LP-50	Easy tasks	F=1	St=2	
LP-56	Seamless	F=6	St=0	
LP-57	solicit student feedback	F=2	St=1	
Constructivist				
LP-5	Questioning	F=14	St=2	
LP-45	Elicit info from student	F=6	St=0	
LP-15	Reading class material	F=10	St=0	
LP-16	Repetition	F-2	St=5	
LP-19	Present challenges	F=11	St=1	
LP-22	create the unexpected	F=5	St=0	
LP-60	Make each class count	F=1	St=1	
LP-59	Computer	F=0	St=4	
LP-54	Student helps design instruction	F=1	St=0	
Collaborative				
LP-8	Individual attention	F=3	St=4	
LP-58	Stu & instr work tog to solve prob	F-1	St=0	
LP-18	Small groups	F=9	St=0	
Stories				
SL-33	Stories	F=3	St=1	
Learning Style				
LP-12	Hands-on	F=0	St=5	(from stu char - st=3)
LP-13	Visual	F=27	St=1	(from stu char –st= 5)
LP-6	Vary instr methods	F=8	St=1	
LP-41	Use of color	F-2	St=0	
LP-48	Teach learning strategies	F=9	St=4	
Make connections				
LP-10	Relate classwork to stu experience	F=15	St=5	

LP-17	Relevant examples	F-4	St=1
LP-24	have students make connections	F-12	St=1
LP-30	Provice background/context/info	F15	St=1
Using Writing in Learning Process			
LP-4	Focused freewrite	F=7	St=0
LP=25	Have students summarize	F=2	St=0
Emotional			
LP-8	Emotional support	F=5	St=0
LP-22	Create the unexpected	F=5	St=0
LP-23	Humor	F=1	St=1
LP-35	Create successful exp	F=3	St=1
LP-47-	Make class fun	F=3	St=2
Organizational			
LP-21	Syllabus	F=2	St=2
LP=52	Pace of class	F=0	St=1
LP-55	Inconsistent methods	F=1	St=1
LP-31	Experiment	F-0	St=1

Outcome of Instruction

Social

O-1	Understand place in universe/world	F=6	St=1
O-7	Make connections to self/others	F=13	St=0
O-21	Literate society	F=1	St=0

Personal Development

O-7	Make connections to self/others	F=13	St=0
O-1	Understand place in universe/world	F=6	St=1
O-18	Heightened level of discovery	F-2	St-1
O-20	Improve self	F=3	St=3

Educational

O-2	Understand prerequisite info	F=5	St=9
O-6	Intro to college environment	F=2	St=0
O-13	Refresh, brush up	F=1	St=6
O-14	Foundation/fundamentals	F=2	St=5
O-8	Grade	F=9	St=5
O-22	Obtain a degree	F=1	St=0
O-9	Drop out	F-7	St=2

Thinking

O-3	Conceptual skills	F=6	St=0
O-2	Understand prerequisite info	F=5	St=9
O-10	Instruction sticks	F-4	St-1
O-11	Ah ha experience	F-2	St=0
O-12	Transfer knowledge	F=2	S5=2
O-15	Critical reading	F=5	St=0
O-16	Notice details	F=5	St=1
O-17	Higher order thinking	F=9	St=0
O-23	See writing as expression of self	F=2	St=1
O-24	application of ideas	F=5	St=1
O-25	Careful of work	F=1	St=0
O-31	Enhance student level of attention	F-3	St=0

Writing

O-4	Improved Writing	F=5	St=22
O-19	Writing is easier	F=0	St=7
O-23	See writing as expression of self	F=2	St=1

Job/Employment

O-28	Job application	F-0	St-1
O-5	Job Prep	F=3	St=9

Other

O-27	Improve handwriting	F-0	St=1
O-26	Visualize work	F=2	St=0
O-29	Help family member with homework	F-0	St-1

Instructor Characteristics

	Faculty			Student
	B	R	T	
Teaching Technique				
Adjust to student needs/capabilities	2		1	
Make mistakes		1		
Listen	1			
Quality of Instruction				
Clarity				1
Inconsistent methods				1
Assumes students learn material				1
Theoretical Perspective				
Refer to theorist/theory	1		1	
Brain-based theory	7	1	9	
Conversations with colleagues	1			
Reflection on Teaching				
Self-eval/reflection	7			
Try something new	5		1	
Make lesson my own	2			
Think carefully about what I do	4			
Attitudes				
Attitude toward DS Student	1			
Confident	1	1		
Anxious/nervous	1			
Identify with students		1		
Challenge with work				
Overload	1			
Feel need to cover content	2			
Tired	1			
Background				
Working class background		2		
Administrative System				
Restrictive Structure				
Student support system				
Instructor freedom				

Writing Process	Faculty			Student
Category	B	R	T	

Writing Process				
General Writing Process	4	1		1
Come up with ideas			1	9
Ideas from mind to paper				11
Prewriting	1			
Organize			3	6
Brainstorming				4
Freewriting				2
Grammar/Mechanics				
Grammar, mechanics				
Sentence structure	2	10		18
Proofreading				11
Syntax		1		
Spelling			3	5
Writing Considerations				
Audience	3			
Purpose	3			
Analyze writing situation	4			1
Person/point of view	1			
Paragraph Elements				
Topic sentences	8			
Develop points	8		1	
Thesis statement		1		
Paragraph development	1			5
Types of Writing Assignments				
Expository Paragraph	1			
Comparison/Contrast	7	1	1	2
Inclass Writing	3			
Creative, Free form				3
Response		2		
Cause/effect		1		1
Argument				2
Journal				5
Narrative				1
Stylistic Elements				
Flow				4
Better wording/word choice				3
Writer's voice				1
Reading/Writing/thinking				
Analyze Reading		1	1	