

DISSERTATION

BRAIN COMPATIBLE TEACHING AND LEARNING
IN THE FOREIGN LANGUAGE CLASSROOM: TEACHERS' VOICES

Submitted by

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In partial fulfillment of the requirements

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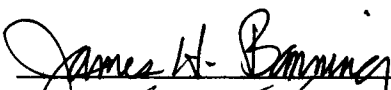
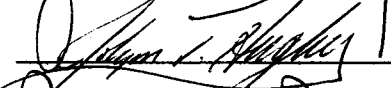
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WE HEREBY RECOMMEND THAT THE DISSERTATION PREPARED UNDER OUR SUPERVISION BY MELITTA WAGNER-HEASTON ENTITLED BRAIN COMPATIBLE TEACHING AND LEARNING IN THE FOREIGN LANGUAGE CLASSROOM: TEACHERS' VOICES BE ACCEPTED AS FULFILLING IN PART REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY.

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ABSTRACT OF DISSERTATION
BRAIN COMPATIBLE TEACHING AND LEARNING IN THE FOREIGN
LANGUAGE CLASSROOM: TEACHERS' VOICES

The purpose of this qualitative study is to discover foreign language teachers' perceptions of brain-based teaching and learning and how these principles affect student learning. To gain an understanding, examine, and describe these teachers' experiences with brain-compatible teaching and learning. While some research has been directed toward second language acquisition and brain-based teaching and learning little has focused on the phenomenon of what foreign language teachers' experience has been with these principles.

This study included a qualitative research design in the phenomenological tradition. Seven k-12 foreign language teachers, familiar with brain-based teaching and learning, from throughout the state of Colorado were interviewed. In this study the terms brain-based teaching and learning is also referred to as brain-friendly or brain-compatible.

Based on the four main research questions, ten themes were identified in the study. These included how learning happens, teacher and learner responsibility, connecting teaching and learning, active learning, internalizing learning, countering student apathy, fun versus fear, instilling love of language, and promoting success. Two essence themes emerged from the teachers' interviews. The essence of their experiences communicated itself as a bond between teacher-student engagement and the setting of the

life experience that is their connection. This hybrid model of covenant and context formed the framework through which effective teaching and learning could be realized. In a shared understanding teacher and learner form a learning system where deeper learning occurs. The nature of the experience is reflected in how teacher and student relate and interact with one another which is the covenant. The quality of the experience centered on the context. The context includes environment, structure and relevancy. This synergistic approach to effective second language learning is supported by the principles of brain-based theory on how one learns. Much the way neural networks work together to form a memory network, the covenant and context model describes how the understanding and actions of people working together increase overall effectiveness.

Based on the findings in this study, additional research in the realm of brain-based teaching and learning and second language acquisition is needed. Further examination of brain-based principles as they relate to foreign language pedagogy at different levels of instruction is also warranted. This study provides a basis for future research that should establish ways to place brain-based teaching and learning principles into foreign language education practice. In an effort to increase effectiveness of teaching and learning in second language classrooms, foreign language methods courses in teacher education programs may benefit from the findings in this study. Increased awareness and visibility of how the brain learns and how instruction should be structured is critical to effective learning.

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DEDICATION

This dissertation is dedicated to:

My husband Mike Heaston who never failed to encourage and believe in me during this emotional journey in my pursuit of a doctorate degree.

My son Niki Singlaub and daughter Aneka Singlaub who offered unconditional support and love. You are my champions.

My parents Nikola and Marija Wagner who provided continual encouragement and expressed overwhelming pride in my success.

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Finally, I must express special thanks and gratitude to Dr. Jean Lehmann who chaired my dissertation committee and was not only my adviser but mentor as well. After switching my topic focus, changing advisors and committee members several times, Jean remained true. Jean provided direction and support every step of the way. After leaving our meetings I was always energized to continue. Jean's validation of my work instilled me with confidence and strength. Thank you so much for your faith in me when I needed it the most.

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How could I have survived and completed my doctoral program without the loving support of my family? Thank you all for living this exciting adventure with me. Thank you Niki for taking the time to help me with technology and editing issues. Without all of your emotional support I could not have completed this program. You were the champions who instilled confidence and strength in me through your love. I needed you to reach my personal goal. I share this accomplishment with you!

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CHAPTER I

INTRODUCTION

As a consequence of our increasingly multicultural and multilingual society, enrollment in foreign language education has shown marked increase in the last ten years. In the past decade, elementary schools offering foreign languages have increased by nearly ten percent (Rhodes & Branaman, 1999). The 1999 survey completed by Rhodes and Branaman indicates that 31% of the elementary schools in the United States offer second language instruction up from 22% a decade earlier (Gilzow & Branaman, 2000). Additionally, there is a growing tendency of placing more emphasis on second language (L2) learning at the secondary and college levels. Colleges and universities often require that students demonstrate competency in foreign language course work prior to graduation (Sparks & Ganschow, 1992). These trends seem optimistic and positive in nature.

But what are the implications for foreign language teachers? How will foreign language educators keep up with current ideas for improving not only their teaching repertoires but student learning as well? L2 teachers are called upon to instruct students coming from a wide variety of backgrounds both socially and educationally. Government mandates and policies have also increased the burden. The inclusion of foreign languages in the “core” curriculum in the Goals 2000: Educate America Act, the release of national and state Standards for Foreign Language Learning (Rhodes &

Branaman, 1999), the enactment of the No Child Left Behind Act (2002) and the Bush administration's proposed National Defense Education and Innovation Initiative (2006) necessitate a review of foreign language teaching philosophy and practices in an effort to significantly increase Americans' foreign language competency. With the impact of the adoption of national standards for foreign language education at the state and district levels, foreign language programs need to evaluate and revise curricula (Gilzow & Branaman, 2000). Teachers have the daunting task of increasing their awareness and application of new methodologies to create a learning environment conducive for all students. Effective second language acquisition requires that teachers attain a better understanding of educational linguistics and how language impacts teaching and learning (Fillmore & Snow, 2000). Fillmore and Snow argue that increased knowledge about how language is acquired will enhance practice in general.

In the field of foreign language education, researchers have typically focused on communicative approaches that encourage speaking (Galloway, 1993; Oxford, 1990) or content based approaches that rely on acquisition of language through comprehensible input derived from authentic context (Krashen, 1982; Omaggio Hadley, 1993). Others presented research that connected multiple intelligence theories (Gardner, 1985), diverse learning styles and natural learning (Krashen & Terrell, 1983) to facilitate language teaching and learning. Recently some have ventured into exploring the neural highways of the brain and their relationship to language acquisition (Caine & Caine, 1991; Genessee, 1994; Jensen, 1998; Pinker, 2003; Sousa, 2006). Cognitive neuroscientists view the nature of learning as a physiological process. The relationship between the physiology or brain function and learning has intrigued educators. Learning has taken on

a new persona. She is both a cognitive science (a study of the mind) and a neuroscience (a study of the brain). In trying to answer the question; what are the best practice approaches to instruction, educators became motivated to delve deeper into how the brain receives, transmits, and stores information. A need to understand the mind-brain evolved.

With advanced neuroimaging technology, scientists have the opportunity to view and record synaptic impulses in the brain that occur when information is being processed. Strategic areas of the brain may now be examined and data collected on diverse levels of functionality. Not only neuroscientists but educators may benefit from this modern technological expertise when assessing student learning.

Foreign language educators and researchers alike, wishing to keep up with the current ideas for improving their repertoire of teaching skills and strategies, must inform themselves of the studies on language acquisition and the brain. Recent brain research, combined with effective foreign language teaching methodology, provides the framework for this inquiry. A presentation of the literature highlighting viewpoints on neuroscience, general pedagogy, constructivist theory and foreign language pedagogy underscores the importance of linking implications from brain studies with effective learning and, specifically, learning in the second language classroom.

The increased interest in research on language and the brain offers L2 educators a rich venue of information of brain-friendly teaching strategies. However, the interpretation of this information and its implications for language acquisition needs further investigation. As the understanding of the brain is continually evolving so must inquiry into the process of learning and the application of effective instruction. We need

to question how brain-compatible teaching strategies relate to student learning. How has research into brain-friendly teaching strategies shaped second language instruction? The last ten to fifteen years of research into how the brain receives, processes, and stores information has not only intrigued neuroscientists but has also prompted educators to revisit teaching and learning within this new context.

The 1990s, coined the decade of the brain by President George Bush, saw a revolution in brain research (Bruer, 1997). This era witnessed critical scientific advances in neuroimaging which provided scientists with the ability to view neural information processing. New information sparks reactions in synaptic reactions. This visualization of brain function is made possible by fMRIs (functional Magnetic Resonance Imaging) and PET (Positron Emission Tomography) scans. Brain function could now be seen as hotspots within the neural highway of synaptic connections. We are able to watch the actual processing of brain activity neuron to neuron (Nunley, 2002). Neuron hotspots indicate parts of the brain that are activated in the event of certain actions (Hung, 2003). Robert Leamson (1999, 2000) refers to this as a “biological brain change” which he contends is learning. Learning as memory, he continues, is a critical component of acquiring knowledge. Is this process of acquisition of knowledge critical in connecting current research to classroom practice? Is the fuss about brain research justified? questions educational consultant David Sousa. “Despite all the rhetoric about reform, teaching and schools have changed little as old practices die hard. Lecturing continues to be the main method of instruction in secondary schools, and the overhead projector is often the most advanced technology used. For many students, school is seen as a dull,

non-engaging environment that is much less interesting than what is happening outside of school.” So is this fuss justified? “Absolutely”, responds Sousa (1998, p. 32, 52).

Purpose

The purpose of this study will be to acquire an understanding of and examine second language teachers’ experiences with brain-compatible teaching and learning in their classrooms. Although there exists extensive research in second language acquisition and the brain that sheds light on how learners acquire language, this body of literature does not focus on teachers’ day to day experiences in the classroom. Teachers experiences with student learning and language proficiency is the guiding focus of this study. Foreign language teachers’ experience with brain compatible teaching strategies is the framework. Since this study develops an understanding of a phenomenon, teachers’ experiences, the emergent nature of this inquiry suggested a qualitative approach to research design. Thus, I chose to conduct a phenomenological study which consists of a series of interviews and observations with high school foreign language teachers who teach an introductory second language class. This approach is an attempt to understand empirical matters from the perspective of the informants. Miles and Huberman (1994, p. 127) refer to this approach as an “exploratory foray”. The study explores the experiences of foreign language teachers who have prior knowledge of brain-based teaching and learning.

The interviews focus on these teachers’ experiences and perceptions of brain-compatible teaching strategies and student learning. I concentrated on the examination of research on the brain and memory functioning to develop insights into language

acquisition and to suggest implications on second language teaching techniques based on this study. The qualitative paradigm is most effective in describing the meaning and experience of foreign language teachers who use brain compatible activities in their classrooms. Qualitative research assumes that reality is subjective and multiple as experienced by the informants (Creswell, 1994). Through extensive interviews, the voices of foreign language teachers provide insight into student learning. Classroom observations are intended to support theory in practice. The narratives from the interviews provide contextual background. This inquiry proposes to advance the field of knowledge and have application within foreign language teaching and learning.

Research Questions

According to Creswell (1998), “questions in a phenomenological inquiry are stated broadly without specific reference to the existing literature. This is exploratory research where the researcher listens to informants to build a picture” (p.102). Essentially this study describes foreign language teachers’ perceptions of brain-friendly practices in the classroom. It is this researcher’s intent to create a sense of verisimilitude “being there” for the reader, critical in a phenomenological study. In addition, with a lack of substantial empirical data to inform our practice in the arena of neuro-pedagogy, additional research in this field of endeavor may provide a missing link between brain biology and learning. To draw a more comprehensive picture of the implications of brain compatible learning applied in foreign language instruction, this study proposes to answer the following questions by listening to teachers’ voices:

- 1) What is brain compatible teaching and learning?
- 2) What are teachers' experiences with brain compatible teaching strategies?
- 3) To what extent do these strategies affect student learning in your classroom?

Definition of Terms

Amygdala attached to the end of the hippocampus plays an important role in emotions, especially the fight or flight response in regulating a person's interaction with the environment (Sousa, 2006).

Axon refers to the connective branch of the neuron that conveys messages through the synapse to other neurons (Howard, 2000).

Brain-based learning involves using approaches to learning that rely on recent brain research to support and develop improved teaching strategies. Researchers theorize that the human brain is constantly searching for meaning and seeking patterns and connections. Authentic learning situations increase the brain's ability to make connections and retain new information (McBrien & Brandt, 1997).

Brain-Compatible Teaching and Learning means the teaching and learning processes that work in concert with the brain's natural methods for acquiring information, skills, and insights (King, 1997).

Cerebral cortex is the part of the brain associated with rational thought; also called the cerebrum (Howard, 2000).

Comprehensible input claims that language can only be acquired when one comprehends the message (Krashen, 2003).

Dendrite refers to the connective branching of the neuron that receives messages across the synapse from other neurons (Howard, 2000).

Enriched Environment describes a learning surrounding which promotes safety, security and love; an environment that is rich in sensory experiences, stimulation, challenge and is free from threat (Diamond & Hopson, 1998).

Epistemology is the branch of philosophy that studies the structure of knowledge (Howard, 2000).

fMRI (functional Magnetic Resonance Imaging) reveals what parts of the brain are active during particular tasks by images of the blood-flow patterns (Howard, 2000).

Hippocampus part of the limbic system that plays a major role in consolidating learning and converting information from working (short-term) memory to long-term memory (Sousa, 2006).

Language acquisition refers to the subconscious process by which language is acquired, similar to knowledge that is stored in our brain subconsciously, through a natural process (Krashen, 2003).

Plasticity is the capacity of the brain to learn, remember, reorganize, and recover from damage, to rewire itself, and make new cells (Howard, 2000; Kotulak, 1997). Neurons sprout dendritic connections or reorganize themselves on the basis of new learning (Caine, 2004).

PET Scan (Positron-emission tomography) catches the level of activity of specific areas of the brain at specific points in time.

Synapse is the point of connection between two neurons (brain cells) in the brain (Kotulak, 1997). The synapse is believed to be the basic unit of learning (Howard, 2000).

Study Delimitations

This study focuses on the experiences of seven foreign language teachers who are familiar with and incorporate brain compatible teaching strategies in their classroom. An initial group of 10 to 12 participants was anticipated. Close to twenty teachers responded to the inquiry however seven teachers met the requirements of the study and were available for interviews. Recruitment occurred through recommendations received from researchers and professors familiar with brain based learning principals and will be followed by a general request for participants posted on the Colorado Congress of Foreign Language Teachers (CCFLT) website. Responses were examined and teachers chosen that meet the criterion of my study. Purposeful sampling was used to include those individuals who were familiar with the phenomenon or experience and could best answer the research questions. The basis of this sampling strategy lies in the inherent focus of a phenomenological study. Informants had to meet the aforementioned criteria. Miles and Huberman (1994) refer to this procedure as criterion sampling where the individuals studied have all experienced the same phenomenon. By the bounding nature of the sample of individuals chosen, this study does not necessarily have applicability to all areas of foreign language instruction.

Significance of Study

Indisputably, student learning is central to education. Increased awareness and understanding of new approaches to teaching and learning are critical to human development. Due to recent breakthroughs in neuroimaging technology, we are able to observe neuronal activity as information processing takes place. The implications of this new technology for education in general are dramatic. Only recently have foreign language educators embraced brain compatible teaching methodologies into their repertoire of skills. Many L2 teachers may still be unfamiliar with this new research. However increased exposure to these new concepts and further research into teachers' experience with these strategies offer the field of second language education an increased knowledge base. The findings in this study, while not generalizable, inform a broader audience on the implications of brain compatible teaching and learning in the second language classroom. The field of education is in constant flux, reviewing, revising, researching, and implementing practices and policies with the purpose of improving student learning and achievement.

Ongoing research in the neurosciences forces critical analysis of the relationship between brain biology and learning. Experience "sculpts" the brain but how and how much are still under investigation. The net impact of my study is not so much to change accepted theory and practice but rather to deepen and enrich our current understanding. Teachers must offer students brain-compatible instruction that strengthens accepted curriculum. This study offers the field of foreign language education additional pedagogical information from which to incorporate brain compatible teaching strategies within the current domain of "best practices".

Researcher's Perspective

The strongest partiality that I bring into this study is my personal background in second language acquisition and foreign language teaching. German is my heritage language learned from infancy as my “mother tongue”. English is my second language acquired as a child immigrant to the United States in the early 1950s. My third language is French which I learned during my teenage years while living in Belgium and attending French speaking schools. During this time I also studied Latin, Greek, and Dutch. I was raised in a multi-lingual family where my parents spoke Serbo-Croatian together and German and later English to their children. If anyone experienced multi-linguas at once I am certainly a prime participant.

Raised and nurtured in this rich language environment fueled my desire to teach languages later in life. My unique perspective on language learning also caused me to question language teaching methodologies and accepted strategies. While total language immersion certainly offers optimal proficiency it remains an awesome task to accurately duplicate an immersion setting in our classrooms. For a student learning a second language feeling more or less at home in another language and culture is without exaggerating a monumental undertaking. Thus, the second language teacher is faced with the daunting task of effectively juggling different teaching strategies not only to fit her students' various needs but to help them acquire a feeling of comfort in another language. As an educator I found myself searching for improved practices to facilitate learning while keeping students engaged.

Learning styles and multiple intelligence theories offered diverse methods of curriculum delivery. The natural learning approach mirrored closely the language learning process experienced by infants learning their first language. The natural approach followed by the advent of neuroscience research offered a recognizable link between how the brain develops to how we learn and ultimately how we acquire language. Fascinated with the inner workings of the brain and how information is received, processed, and stored, I began my quest to discover if there were studies that specifically targeted second language acquisition and the brain from which I could broaden my own repertoire and enlighten my discipline as well. Through disciplined inquiry, I offer foreign language educators additional information which may be useful and appropriate to throw into their own bag of teaching tricks.

CHAPTER II

REVIEW OF LITERATURE

Since this study investigates teacher perceptions of brain-based learning strategies in the second language classroom, it is important to review the evolution of language learning theories. This chapter will provide a broad overview of the research in the fields of second language acquisition and brain based learning. This overview is warranted to understand the emergent nature of language acquisition as well as to acquaint the reader with possible theories linking second language learning to brain compatible teaching and learning strategies. The following literature serves to support, explain, illuminate, or question the inquiries raised in this research.

The following review of literature begins with an historical overview of prominent language learning theories and methodologies. Each major topic area highlights significant authors and applicable research which is then followed by a discussion of the scholarly work presented. Examples of relevant teaching strategies reinforce the theories presented and lend further credence to the purpose of my investigation.

Second Language Teaching Theories

Teaching language evolved from its earliest stages in traditional approaches to the teaching of Latin and Greek. This method of instruction named Grammar Translation Method was the primary process of language instruction in the eighteenth and nineteenth

centuries (Richards & Rodgers, 2001). Students were required to read noteworthy classical works to develop scholarly minds. Emphasis was placed on meticulous analysis of the target language with a strong focus on grammar structure. Translation exercises comprised the majority of the learner's attention. Students were instructed in their mother tongue with little or no attention to speaking or listening skills. The authors argue that the Grammar Translation Method served no utilitarian goal. However the term 'method' in language learning prompted the emergence of the concept of teaching practices based on a particular theory (Rodgers, 2001).

The Age of Methods

From the 1940s until the 1960s the element of audio was popularized (Richards & Rodgers, 2001). With the emergence of television, which integrated aural and visual components, the audio-lingual method in language laboratories was introduced. The main goal with the aural-oral method was to acquire a second language through rapid acquisition of speaking and listening skills. This method offered a revitalization of L2 learning in that audiolingualism de-emphasized the traditional Latin-Greek based grammar method technique in favor of an active approach (Curtain & Pesola, 1994).

The era referred to as the "Age of Methods" saw the advent of four primary methods; the Silent Way, Suggestopedia, Total Physical Response (Asher, 1988), and Communicative Language Learning (Richards & Rodgers, 2002). Rodgers refers to these methods as prescriptions for language teaching (Rodgers, 2001). The Silent Way developed by Caleb Gattegno makes use of mime, gesture, and visual aids including color-coded pronunciation charts. With the teacher providing guidance only, saying very

little the student is thus required to take responsibility for his/her learning through discovery. Suggestopedia proposed by Georgi Lozanov at the University of Sofia in the late 1960s (King, 1997) centers on the science of suggestion; strong belief that the brain, especially the right side, can be stimulated through the power of suggestion. This teaching method had students learn to remove anxiety through relaxation exercises. Language was introduced through music, visual images, and rhythmic matters. However, little attention was paid to grammar. Learners acquired language without much focus on structure.

Total Physical Response (TPR), in contrast, relied heavily on a kinesthetic approach. Language was taught through a speech act-plus-movement language acquisition technique (Seely & Romijn, 1996). In the early 1960s, James Asher experimented with teaching language through action. His strategy lies in giving commands in a second language, modeling the physical responses to them and then having students mimic the same responses (Seely & Romijn, 1996). The proponents of TPR argue that since language is behavior, students require the visual and kinesthetic accompaniment to words for learning to occur (Lipton, 1998). TPR strengths lie in developing language comprehension skills through action and are primarily associated with an aural-oral approach to SLA.

The concept of using a second language to communicate on a personal level slowly found its way into teaching language at the turn of the twentieth century and overshadowed the previous methods. An interactive view of language teaching propelled language educators to concentrate primarily on the communicative aspect. Second language acquisition (SLA) theory introduced in the 1980s by Stephen Krashen opened

the door for increased research and inquiry into the spoken rather than the written learning of a second language.

Similarly the Communicative Language Teaching (CLT) overshadowed previous grammar structured methods, by focusing on a more realistic, whole language approach. CLT advocates believed that students needed to learn a second language to communicate. Communication needed to be authentic and real (Galloway, 1993). This approach presents the second language learner with real-life situations that necessitates communication. Unlike the audio-lingual and TPR methods of teaching, which rely on repetition, drills, and modeling, the communicative approach allows for unexpected outcomes. The motivation to learn comes from a student's desire to respond in a meaningful way according to his/her own thought pattern. Communicative Language Teaching opened the way for a more natural approach to learning a second language. Thus, the Natural Approach was born. American linguists Stephen Krashen and Tracy Terrell (1983) postulated that language is best acquired naturally. This process is similar to the way children develop ability in their first language. Language needs to be interesting, relevant, comprehensible, and natural (Curtain & Pesola, 1994). Krashen and Terrell (1983) believed that the learner has two ways of attaining the ability to perform in a second language, tacit (or subconscious) acquisition and conscious learning. Tacit learning occurs when the learner is unaware that it is happening, when it sounds right or feels right, which the authors refers to as a kind of 'internal natural syllabus of acquisition'. This internal syllabus results in similar errors at similar moments regardless of the language you learn. The authors proposed that similar difficulties in learning ones native tongue are reflected in the learning a second language. Conscious learning relies

on prior knowledge of second language rules, knowing about the language. Krashen (1982) refers to this as a kind of 'conscious editing process'. When input to the learner is comprehensible, meaningful, and presented in an authentic setting, learning will occur.

Inductive versus Deductive Learning

The previous methods mentioned, specifically the Grammar Method, relied on a deductive learning process. Students were given parts, rules, vocabulary, and structure from which to understand the whole. Proponents of the Natural Approach prefer an inductive learning process which presents language as caretaker speech or motherese (Curtain & Pesola, 1994). Language is presented in a natural context from which students work out the rules for themselves. Learning is student centered, while the teacher becomes the facilitator. Based on whether learning is acquired deductively or inductively focuses on how the brain receives and processes information. Krashen (1982) believes that students who are successful in deductive language classrooms settings employ different neurological mechanisms than those in inductive settings. He maintains that deductive learners are left brained, analytical thinkers, while inductive learners were right-brained, analogic thinkers. Implications for second language learning based on animal research by Fred Genesee at McGill University suggest that the brain is much more malleable than previously thought (Genesee, 2002). Genesee refers to studies which indicate that specific functions of specific regions of the brain are not fixed at birth. Brain plasticity is dependent on experience. Learning affects brain processing. However, as the author suggests, I believe we should be cautious when interpreting this research since all findings were reported on studies performed on animals.

Adult and Youth Learners

When discussing the methods of SLA and brain processing a necessary question arises. Should language instruction follow the same guidelines for adult learners as for children? From the methods discussed if brain processing is indeed affected by experience and learning, then Krashen's natural approach may not necessarily apply to adult learners. Would logic follow that a more adult oriented approach, perhaps the Silent Way or Suggestopedia methods, be more appropriate? According to Genesee's (2002) research the "window of opportunity" for language learning is from birth to ten years of age and that by the time a child reaches adolescence the brain cannot normally develop any new cognitive system, including language. If we indeed know that the areas of the brain, specifically important to learning, can change over a life span (plasticity), then we accept that teaching strategies must necessarily accommodate this change. Genesee implies in his report on Second Language Learning and Caine and Caine (1991) agree that brain research confirms what we know from educational research. Teaching to a population of diverse learners possessing a variety of learning styles necessitates alternative strategies which take into account brain physiology as well as cognitive development. Educators must approach second language learning, especially for beginning language learners, with a focus on their need for context-rich, meaningful, and authentic environments (Caine & Caine, 1991, Diamond & Hopson, 1998).

A Georgetown University study that focused on late acquired second language argues that language ability, in both first and second language, are sensitive to the age of initial language exposure (Ullman, 2004). The key word in their explanation is

“sensitive”. While the study maintains that late exposure may affect grammatical more than lexical functions of language acquisition, the author suggests that with sufficient exposure to the L2, a learner should eventually acquire the grammar. Ultimately the proficiency may reach that of a learner’s first language. Caution must dictate the use of “window of opportunity” since the window does not shut it simply becomes more difficult to keep open.

Similar arguments and theories were already presented and proposed by Krashen and Terrell in their Natural Approach 20 years earlier. While brain research alone cannot prescribe what and how we teach, it is imperative to reflect on its implications for the teaching and learning of a second language.

Today’s foreign language teachers are faced with students from various social, economical, and educational backgrounds. With a belief that all students can learn and benefit from language study comes the task of how to teach such a diverse group of learners. In particular, what teaching methods and strategies maximize students’ learning? A clearer understanding of individual differences in learning styles may indeed be related to the workings of the brain. Research in understanding the workings of the brain is continually evolving. Informed practice requires that educators increase their knowledge base with brain-based research as well as traditional approaches in planning effective instruction. There needs to be a stronger focus on teaching language learning strategies to all diverse learners based not only on their learning style but with an insight into how the brain processes information as well. This marriage of cognitive and neuroscience approaches will help students become more effective and independent learners. An analysis of learning styles, strategies, and instructional methods of second language

acquisition coupled with brain-based teaching strategies will offer further insight into effective teaching practice.

Styles and Strategies in Second Language Learning

What is meant by a learning style? In *Language Learning Strategies: What Every Teacher Should Know*, Rebecca Oxford (1990) defines learning styles as aspects of a person, which are inherent and pervasive. The style by which an individual learns is a blend of cognitive, affective, and behavioral elements. These elements relate to preferred or habitual patterns of mental functioning, patterns of attitudes and interests that affect what an individual pays most attention to, a tendency to seek situations compatible with one's own learning patterns, and tendency to prefer certain learning strategies and avoid others. Similarly Sims and Sims (1995) believe that an experiential learning model takes into account individual characteristics, a model which affirms the presence and validates individual learning styles. They posit that "characteristic cognitive, affective and physiological behaviors serve as stable indicators of how learners perceive, interact with and respond to the learning environment" (p. 12).

Many different dimensions of learning styles have been identified in research. Howard Gardner's (1983, 2003) multiple intelligences theory expands on the notion that all learning is either auditory, visual, or of a kinesthetic nature. He identified eight (currently researching number nine) intelligences: linguistic, musical, logical-mathematical, spatial, bodily kinesthetic, interpersonal, intrapersonal, and natural (existential) (Kerzner-Lipsky & Gartner, 1997, Gardner, 2003). Whereas Oxford refers

to stylistic preferences based on, dependence versus independence, analytical versus global processing, cooperation versus competition, and tolerance versus ambiguity. Oxford states that the independent learner can separate key details from a complex situation while a dependent learner cannot. Brain hemisphericity proponents believe that different lobes of the brain dictate whether an individual learns through analysis or auditory and visual patterns. This theory mirrors, to some degree, Gardner's logical-mathematical and spatial analogy. Students who tolerate ambiguity often show better language learning performance (Oxford, 1990).

What are learning strategies? The National Capital Resource Center's Guide for Secondary Foreign Language Educators (2004) defines learning strategies as: "...the thoughts and/or actions that students use to complete learning tasks" (p.14). From this definition we understand that learning strategies are tools that students use independently to learn a language. It is important to note that teaching strategies, on the other hand, differ in that the teacher takes on a facilitator role. The focus is on students who are given direction on how to analyze and reflect on their own learning.

In a perfect world if we were to accurately connect a learning strategy to a learning style, teaching students could well become effortless. Unfortunately, as every teacher can attest, students are not simply empty receptacles into which you pour knowledge. Finding the appropriate teaching techniques and learning strategies necessitates a classroom culture that demands more complex interaction between the teacher, the learner and the material being learned.

So how else can we define learning strategies? According to Neil Sturmski (1997), learning strategies are conscious or unconscious steps, techniques, and rules that

facilitate learning. These ideas reflect those presented much earlier by Krashen (1982) and his colleagues in discussing tacit language acquisition and one's internal syllabus. These strategies reinforce the acquisition, storage, and recall of information. The teacher's goal is to help students become more efficient learners by teaching them how to learn. Learning is facilitated by the use of self initiated strategies. Sturmski categorizes strategies into 'what we think about' (the cognitive aspect) and "what we physically do' (the behavioral aspect). If we agree that the primary causal factors in successful or unsuccessful second language acquisition are linguistic and that students demonstrate similar learning difficulties in their first language (Pritikin, 1999), we can propose similar learning strategies in conjunction with diverse methods of instruction.

Methods and Techniques Based on Learning Strategies and Styles

Foreign language instructors must be educated in methods based on multiple modalities. This approach to instruction mirrors that proposed by researchers of the learning disabled (LD) and is inherently a form accommodating all students (Ganschow, Sparks, & Javorsky, 1998, Pritikin, 1999).

There are many different methods a teacher can use to aid students in acquiring a second language. Diverse methods of instruction can benefit all students involved in foreign language study. Two approaches identified in the literature, proposed by Ganschow and Sparks marked a turning point in understanding the connection between methodologies used to teach LD and L2 students.

The first and widely researched approach stated that students having difficulties in L2 acquisition also have phonological deficits in their first language (Schwartz, 1997). Phonemes, from the Greek word for voice ($\psi\omicron\nu\eta$), or sound system of the second language need to be explicitly taught. Sounds (auditory) need to be presented in a highly structured manner with a great deal of visual and kinesthetic practice and input. This approach centers on the basic elements of learning styles discussed earlier. The phonological approach is adapted from research reported in 1969 by Gillingham and Stillman, thus named Orton-Gillingham method of teaching. These researchers studied effective methodologies for teaching students with difficulties in reading, writing, and spelling in their first language. Elke Schnieder of Miami University of Ohio, a collaborator in the Orton-Gillingham method, had significant success in teaching German to LD students using this approach (Schwartz, 1997). Schneider's work provided further credence to the importance of a highly structured, multisensory, direct and explicit approach to second language acquisition. This method placed a strong emphasis on metacognitive aspects of language in both the native and second language. Thus students understand how a language is structured, recognized linguistic rules and repeated structure patterns (Schneider, 1996).

Fillmore and Snow (2000) assert that teachers need a deeper understanding of linguistics, how language impacts teaching and learning, in order to accommodate diverse learners in English as a Second Language Programs (ESL). They argue that knowledge about language structure will not only enhance student learning but teacher practice as well.

However, does explicit teaching of rules, with frequent repetitive patterns run contrary to the previously accepted content-based, natural approach presented by Krashen and his advocates? Schneider believes it does. I see this method not necessarily as an opposing approach to SLA, but an extension of and enhancement to learning a second language within a contextual format. Students learn structure and apply this learning to understanding meaning within authentic materials. As long as the context presented is comprehensible and relevant to a student's environment, learning will take place. Contextualization relies on pictures, props, pantomime, physical activity, and video. When students are taught to recognize phonemes, to decode (read words) efficiently, and to encode, or apply the sounds to the written language, coupled with a strong language-rich contextual background (Hintergrund) they will gain a better understanding and increased confidence.

The second approach is the adaptation of principles of instruction known to be effective and focuses on positive self-esteem, non-threatening environments, and students' needs (Diamond & Hopson, 1998). Additionally, compensation for processing time and individual learning style are imperative to help the learner feel more comfortable in the L2 classroom. Slowing the pace of instruction, providing constant review and consistent multisensory input (visual, auditory, tactile, and kinesthetic) are not only vital in informing our practice on effective teaching and learning techniques but also in providing information for curricular reform.

A third method, based on a meta-cognitive approach, employs mnemonic devices and strategies to encode (take in) and then retrieve (remember) information. Mnemonic strategies are systematic procedures for enhancing memory (Mastropieri & Scruggs,

1998). Students can learn by creating links to things with which they are familiar. An example from Mastropieri and Scruggs is as follows. What is the capital of Florida? A keyword, flower is used for Florida. Students then make a connection with the word television and Tallahassee. Now how do they create an image to make the connection complete? They draw a picture of a television with a flower on the top. With a second language, students use the same strategies for learning information in the native language. The authors further demonstrate association using Italian examples (mela [apple], an apple in a mailbox; capre [goat], a goat dressed like a cop; lago (lake) a log in a lake; fonda [bag], a phone in a bag). An extension of mnemonic devices is the use of acronyms. The same techniques used when we learned the notes represented in the spaces of a treble clef (FACE) can be replicated in learning a second language. German word order for example has a definite structure, which can be represented by the letters SVTMP (subject, verb, time, manner, place). Students learn the pattern and apply it when writing complicated sentences.

The acronym WEIRDO (wishes, emotions, impersonal expressions, regrets, doubts, opinions/obligations) is another example and represents the components of French speech that demand the use of the subjunctive tense. Some of the limitations presented in the research indicate, however, that when students create their own mnemonic strategies, instruction may proceed at a slower pace (Mastropieri & Scruggs, 1992).

The fourth method makes use of real-life situations that necessitate communication, called Communicative Language Teaching (CLT). The communicative approach grew out of dissatisfaction with the audio-lingual and grammar-translation

methods discussed earlier (Galloway, 1993). The instructor sets up situations and encounters that are relevant to a student's environment. These situations necessitate communication. Unlike the audio-lingual method that relies on repetition and drills, the communicative approach allows for unexpected dialoguing, thus increasing a student's desire to communicate in a meaningful way. Galloway offers several examples of CLT that reinforce authentic communication. With a beginning L2 learner for example, a teacher distributes cards with different names in the target language. Students respond to the question: What is your name? using the name printed on their card. They do not know the answer beforehand; consequently there is an authentic exchange of information. Another example for beginning language students is listening for gist. Students use previous knowledge and cognate recognition to decipher meaning. Recognizing cognates (words that look alike and have the same meaning in two languages) in the sentence also reinforces students' use of learning strategies in acquiring meaning.

Brain-Based Learning

Brain physiology and development

“Educational improvement is not accomplished through administrative or legislative mandate. It is accomplished through the attention to the complicated idiosyncratic, often paradoxical and difficult nature of learning.” (Brooks & Brooks, 1999, p. 200)

What is the nature of learning? With the advent of cognitive neuroscience and advanced imaging technologies, scientists now believe that the process of learning can be seen in the electrical-like “hot spots” in the brain. These explorations and new discoveries into the functioning of the brain have moved research beyond clinical observations and into the realm of physiology. The fields of neuroscience and cognitive

science are helping us better understand how people think and learn (Bransford, Brown, & Cocking, 2002). Questions raised concerning how one learns reflect an interest in the mind/brain dichotomy. The cognitive sciences refer to the study of the mind and the neurosciences to the study of the brain (Class notes, 2001). Three main points discussed by Bransford and colleagues (2002) and supported by Howard (2000) are:

1. Learning changes the physical structure of the brain.
2. These structural changes alter the functional organization of the brain; in other words learning organizes and reorganizes the brain.
3. Different parts of the brain may be ready to learn at different times.

A critical point presented in this argument is that learning is viewed as a natural process related to the interconnectedness between emotion and cognition. The term brain-compatible learning reflects the intent of teaching to the brain's natural processing ability at the neuronal level (King, 1997). As long as the brain is not prohibited from completing its normal processes, synapses will fire, axons and dendrites will connect and grow and learning will occur (Caine & Caine, 1990).

How the brain works naturally has a significant impact on what kinds of learning activities are most effective. Educators need to help students have appropriate experiences and capitalize on those experiences. As Renate and Geoffrey Caine illustrate in *Making Connections* (1991, p. 113), three interactive elements are essential to this natural learning process:

- Teachers must immerse learners in complex, interactive experiences that are both rich and real. Educators must take advantage of the brain's ability to parallel process. One excellent example is immersing students in a foreign culture to learn a second language.
- Students must have a personally meaningful challenge. Such challenges stimulate a student's mind to the desired state of alertness.
- In order for a student to gain insight about a problem, there must be intensive analysis of the different ways to approach it, and about learning in general. This is what's known as the "active processing of experience."

Another issued raised is that the brain, formerly perceived as a black box, can now be studied and examined. The brain of an infant, with its billion neurons, is active. The brain once thought to be immutable awaits the outside world to shape and form it. Kotulak (1997) uses the metaphor of a banquet to describe the brain shaping process.

“...the outside world is indeed the brain’s real food...The brain gobbles up its external environment in bits and chunks through its sensory system: vision, hearing, smell, touch, and taste. Then the digested world is reassembled in the form of trillions of connections between brain cells that are constantly growing or dying, or becoming stronger or weaker, depending on the richness of the banquet” (p. 4).

While research into early brain development indicates that the brain power of a child is essentially set at birth, it is requisite upon not only the child’s genetic make up but on its environment to nourish the young brain to reach its fullest potential. According to Wolfe and Brandt (1998), “The brain that eventually takes shape is the result of interaction between the individual’s genetic inheritance and everything he or she experiences” (p. 10). This is a relatively new understanding thanks to the advances in neuroimaging. Prior to these findings, scientists believed the brain was fixed at birth and that as such could not strengthen neurons. As a result of Marian Diamond’s (1998) research with rats in impoverished and enriched environments, they determined the potential plasticity of the brain and its capability to grow new connections on neurons and

extend dendrites. Diamond (1998) and her colleagues at the University of California recorded neuronal pattern changes in rats experiencing enriched environments. This brain plasticity was seen in how “dendritic spines themselves grow, change shape, or shrink as an animal experiences the world” (p. 27). These researchers referred to the extension of dendrites, with extensive branching, as the “magic trees of the mind.” Jensen (1998) takes this analogy a step further and describes cell growth by way of dendritic branching as “neural forests” (p. 14). Leamson (1999) states quite simply that these biological changes in the brain is learning. “Learning is defined as stabilizing through repeated use, certain appropriate and desirable synapses in the brain (p. 5).

Mind-Brain theory

Principles of Mind-Brain learning (Table 1) presented by Renate Nummela Caine and Geoffrey Caine (1991) capsule research findings on brain development and learning and support the aforementioned researchers’ claims of brain plasticity. The authors offer twelve principles as a framework to guide instruction and ultimately enhance learning. This reconceptualization of teaching, with the brain in mind, deepens our understanding of the physiological aspects of cognition while orienting instructional practices toward teaching for deeper understanding.

Table 1

Mind/Brain Learning Principles (Caine & Caine, 1991)

<p>Principle One: The brain is a complex adaptive system.</p> <p>Principle Two: The brain is a social brain.</p> <p>Principle Three: The search for meaning is innate.</p> <p>Principle Four: The search for meaning occurs through "patterning".</p> <p>Principle Five: Emotions are critical to patterning.</p> <p>Principle Six: Every brain simultaneously perceives and creates parts and wholes.</p> <p>Principle Seven: Learning involves both focused attention and peripheral perception.</p> <p>Principle Eight: Learning always involves conscious and unconscious processes.</p> <p>Principle Nine: The brain has at least two ways of organizing memory.</p> <p>Principle Ten: Learning is developmental.</p> <p>Principle Eleven: Complex learning is enhanced by challenge and inhibited by threat.</p> <p>Principle Twelve: Every brain is uniquely organized.</p>
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Cognitive Development

From early research by renowned psychologist Jean Piaget, cognitive development is based on the premise that the brain of a child builds cognitive structures. Piaget referred to these structures as “mental maps or schemes” which aide in understanding and recognizing experiences (Travers, Elliott, & Kratochwill, 1993). This process he posits increases in complexity as the child matures. Maturation allows for the brain to experience the world and in so doing alters its cognitive structure to

accommodate these new experiences. Similarly, Lev Vygotsky's theory on mental development focused on structural changes of the brain dependent on environmental influences (Travers, et al. 1993). The "zone of proximal development refers to the distance between a child's actual development level and a higher level of potential development" (p. 60). Vygotsky (1986) believed this zone delineates a relationship between learning and development. His theory stressed the importance of interaction of humans with other humans, and humans with their environment.

Cognitive development was seen as a qualitative process and not as structured as Piaget professed it to be. Differences aside, according to these psychologists, learning is impacted by developmental stages which include the building of and the expanding on mental schemas, experiences, and interactions with the surrounding environment. While Vygotsky focused on the importance of social processes to determine cognitive development, Piaget believed that "children construct their own ideas on how the world around them works" (p. 62).

Constructivism

At the core of Piaget's and Vygotsky's argument concerning cognitive development, we find an underlying concatenation on the construction of knowledge. A sound reliance on the importance of a learner's creation of knowledge in response to his/her prior knowledge and environment is central to learning whether it evolves around cognitive stages as per Piaget or cultural experiences as per Vygotsky.

Martin and Jacqueline Brooks (1999) define this creative learning approach as constructivism. They argue that constructivist thinking should be at the heart of teaching.

Teachers need to act as facilitators of knowledge and not chefs that spoon feed information. Reflecting on prior knowledge is critical to understanding and development. Students bring with them a vast amount of experience, which may remain untapped. Zull (2002) underscores the primary importance of existing knowledge when he points out that,

The single most important factor in learning is the existing networks of neurons in the learner's brain. Ascertain what they are and teach accordingly (p. 93).

He goes so far as to propose that "neuronal networks are knowledge". Therefore, is it not imperative that educators connect lessons to students' stored schemas or internal syllabus? Similarly, Brooks' image of a "conceptual Velcro ®" is quite ingenious in that the effectiveness in creating links and hooks to prior knowledge (schemas) facilitates the transfer of information into long term memory. Memory, vital in knowledge retention, is dependent upon the workings in the limbic system of the brain. Within this system the amygdala imprints memories through the emotion generated reactions (Kotulak, 1997). Activating prior knowledge is the function of the hippocampus. The hippocampus, working as a relay switch, determines whether the information it receives is worth keeping (Nevills, 2003). Connected learning viewed as a physiological process demands reliance on the amygdala and the hippocampus working in tandem to process what we learn and store it in long term memory.

Constructivist theory underscores the importance of how the brain receives, processes and stores information. While brain processing is similar, how each student constructs meaning differs. Herein lies a paradox. For example, student A needs visual stimulus to set the brain process in motion while student B needs aural stimulus, and

student C needs tactile stimulus, i.e. manipulate a model. In understanding that the search for meaning takes a different route for each student, a teacher needs to be prepared to map out a curriculum that offers diverse roads to learning. This is a daunting task and requires a structured lesson design, which lends itself to a cogent flexibility in execution with an eclectic repertoire of skills.

If constructivism is emergent, self-directed learning, then differentiated instruction is but an extension of it. Providing students with a gift of choice promotes self-reliance, which in turns reemphasizes self-directed learning. I see a burgeoning cyclical pattern that allows for a student's heightened control of his/her learning. As I read through the research, I observe significant links among educational approaches. When we speak of student centered learning are we not discussing constructivist and differentiated instruction?

According to Pettig (2000), the focal point of instruction and delivery lies in a deeper understanding of why we teach and not so much what we teach. She not only questions why we teach but more importantly what we want students to gain. Central to Pettig's article is a proactive approach that necessitates a change in classroom culture. Classroom instruction needs to be redesigned to accommodate our diverse student body. Much of the advice presented by Pettig focuses on how to engage students in the learning process. By providing students with a choice of modality; artistic, verbal, kinesthetic, or visual graphic, we allow for learning to be absorbed through different channels. Similar to the different roads to be taken, students may also choose to ride in different vehicles.

Curriculum is structured in such a manner that learning objectives and goals may be achieved and assessed in different ways. Providing students a choice not only

validates and promotes self-efficacy but also allows for an integration of knowledge using conceptual learning. This permits deeper and more durable learning to occur where students are involved and have some passion and emotion for what they are learning. When a learner encounters connections to his/her own prior experiences and world view, he/she can build new knowledge (Velcro® effect). The restructuring of classroom culture that the author suggests necessitates teaching with a differentiated instructional approach. Approaches will require a complex mix of art, science, self-knowledge, life experience, and even a bit of the magic found in the neural forests.

Learner centered instruction

The restructuring of the classroom culture requires a focus on a student centered learning environment. A strong belief in student self-efficacy drives learning. The ability to shape one's learning by increasing consciousness of how one learns can promote effective learning. The constructs of constructivism and meta-cognition gel into a solid mold which Joyce, Weil, and Calhoun, in *Models of Teaching* (2004, p. 14), describe as an "executive control" over learning strategies. When a learner possesses this control, he/she is actively involved in his/her own learning process. The typically passive teacher centered learning environment in which students are spoon fed information is now transformed into a student constructed active and engaged milieu. Teachers need to realize that the best way to learn is not through lecture, but by participation in realistic environments that offer learners skills in "learning how to learn" (Joyce et al., 2004).

Jeffrey King's article (1997) illustrates this new paradigm shift of teaching and learning. He argues that "you don't learn science by absorbing stuff that has been poured into them via lectures but rather by constructing meaning out of experiences that the teacher provides" (p. 281). The author's statement effectively highlights the critical importance of making learning relevant to the learner. The key word is experience. Through experiential learning an individual can create and absorb knowledge. If a learner is permitted to experience learning through reading, organizing, analyzing, relating, manipulating and finally reflecting on and sharing new information, King believes that effective and deep learning takes place. In addition, this method of instruction permits learners with different styles to interact and share in the acquisition of new material. To illustrate this paradigm shift in the learning of language of teacher versus learner centered instruction, see table 2.

Table 2

Teacher vs. Learner-Centered Instruction

Teacher-Centered	Learner-Centered
Focus is on instructor	Focus is on both students and instructor
Focus is on language forms and structures (what the instructor knows about the language)	Focus is on language use in typical situations (how students will use the language)
Instructor talks; students listen	Instructor models; students interact with instructor and one another
Students work alone	Students work in pairs, in groups, or alone depending on the purpose of the activity
Instructor monitors and corrects every student utterance	Students talk without constant instructor monitoring; instructor provides feedback/correction when questions arise
Instructor answers students' questions about language	Students answer each other's questions, using instructor as an information resource
Instructor chooses topics	Students have some choice of topics
Instructor evaluates student learning	Students evaluate their own learning; instructor also evaluates
Classroom is quiet	Classroom is often noisy and busy

Source: Models of Language Teaching and Learning --The Essentials of Language Teaching (NCLRC).

Brain Research and Practice

How does the current brain research (neuroscience) affect L2 pedagogy (cognitive science)? After a review of the literature, what appropriate generalizations or allegations can we make at this juncture?

This is where I propose an iceberg analogy. Let us look at the iceberg as “learning”. I view the one-third of the iceberg that is visible to the eye as traditional educational theory, bound by research and inquiry and generally accepted as valid pedagogy yet somewhat incomplete and slowly melting. In contrast the greater portion of the iceberg, two-thirds which lies beneath the water, provides effective buoyancy and allows it to float. In this extremely heavy chunk of the iceberg we find student centered learning, brain-based learning, multiple-intelligence theory, constructivism, and natural learning processes. Appropriately, Berman’s (2000) reference to collective participation, active learning, and coherence supports this idea quite well. Teachers and learners become informed and then actively engaged. Teachers are thus encouraged to apply what is presented in the literature and introduced through professional development activities. Unfortunately many only see the tip of the iceberg, perhaps ignorant or simply unaware of a greater importance that lies beneath. They are fooled and naively accept that effective learning can occur in a theory based lecture format. Without an energetic, eclectic, and enlightened approach to teaching methods and learning strategies the iceberg will surely sink and students will suffer.

Much of what we do in our classrooms inevitably centers on what we teach, however it is “how” we teach that is critical to learning. In researching the evolution of language acquisition theory, connections between research on brain processing and SLA theory do share commonalities. Specifically, I find parallels between King’s discussion on how the limbic system and neo-cortex need to work as a team and Stephen Krashen’s, Content Based Language Acquisition theory. Krashen’s “Natural Approach” to language learning proposes that to acquire a language certain affective filters need to be addressed.

These filters help to eliminate stress and threat. King states that when stress and threat are eliminated the brain is forced into higher cognitive processing (neo-cortex). The absence of threat is absolutely essential to effective learning. According to Sylwester (1995); “Emotions drive attention which drives learning, memory, and just about everything else” (p. 72). David Sousa (2006) adds that “how a person feels about a learning situation determines the amount of attention devoted to it. Emotions interact with reason to support or inhibit learning” (p. 44). The ultimate goal, it would seem, lies in engaging teaching strategies that enhance the natural function of brain processing which is strongly linked to feeling physically safe and emotional secure.

The issue of safe environments is also addressed in Marian Diamond’s research that centered on enriched versus impoverished environments. Her studies confirmed that enriched environments promoted the growth of dendrites. Diamond and her colleagues advocated that dendrite growth is the key to increased learning capacity. The parallels between the natural human learning process and the biology of learning embraced by Diamond, Caine and Caine, Jensen, Howard, Kotulak, Leamson, Smilkstein, Sousa, Sternberg, Wolfe, Brandt and Zull and second language acquisition theory necessitate further review and examination. In his reflection on twenty years of MI theory, Howard Gardner urges a reassessment. “In light of the findings of the last two decades, the biological basis of MI theory needs urgently to be brought up to date” (Gardner, 2003, p. 12).

Is brain-based learning a panacea for second language learning? Should neuroscience research guide instruction? While cogent theories and disciplined inquiry provide strength to the argument of creating brain-compatible classrooms, it is ultimately

the voices of those in the know that will lend the necessary buoyancy to keep the iceberg afloat. The essence and multi-meanings lie within the experiences of teachers.

CHAPTER III

METHODOLOGY

This chapter presents how the researcher collected, analyzed and verified the data to answer the research questions. The chapter is divided into several sections. First, the research approach and rationale with an explanation of the design format are described. This section is followed by a presentation of research methods related to qualitative inquiry and the purpose of such research. Highlighted in this section is a brief account of phenomenological inquiry drawing on works by prominent authors. The next section discusses site and participant selection framed within a phenomenology and dependent on criterion sampling procedures. From there, the researcher provides the data collection and analysis strategies and procedures. Finally, I address the issue of validity in the context of the qualitative paradigm.

Research Approach and Rationale

The purpose of a phenomenological study is to research a particular phenomenon and study social conditions in their natural settings (Fink, 1998). It is further a research method which "...is a systematic, empirical strategy for answering questions about people in a particular social context." (Locke, Spirduso, & Silverman, 2000, p. 96). It was my intent to obtain verbal descriptions from L2 teachers of their perceptions of students' brain-based learning in their classrooms. Based also on the researcher's

experience as a L2 teacher, it was important that the researcher interact with the participants to deepen and perhaps support her own experience with these strategies. Additionally this approach enhanced the empirical understanding of the phenomenon from the perspective of those being studied while creating a new story which encompassed the researcher's experience as well as those of the participants.

Creswell (1994) states quite appropriately that "...phenomenology serves as the rationale behind efforts to understand individuals by entering into their field of perception in order to see life as these individuals see it" (p. 275). To further this argument, human discourse and action are seen as rich text; 'a collective of symbols which expresses meaning', meaning derived from a lived experience, *Erlebnis* (Miles & Huberman, 1994). This term, along with life world, *Lebenswelt*, taken from Edmund Husserl's work on phenomenological philosophy is reflected in everyday life as experienced by the participants (Creswell, 1998; Miles & Huberman, 1994). The search for the *Lebenswelt* in this study began with a broad general question which Creswell (1994) refers to as the "grand tour question". What are foreign language teachers' experiences with brain compatible teaching strategies?

Given the emergent design of a phenomenological study and its heuristic, exploratory approach to research, I proposed two additional questions that offered background information and furthered exploration implications for classroom practice.

- 1.) What is brain compatible teaching and learning?
- 2.) To what extent do these strategies affect student learning in your classroom?

Since these questions are broad in nature, the interviews I conducted allowed for open ended responses and thus provided a venue for unique voices to be heard through

open dialogue. Moustakas (1990) states that; “Dialogue is the preferred approach in that it aims toward encouraging expression and disclosure of the experience being investigated”. (p. 47). Qualitative research further assumes that reality is subjective and multiple as experienced by the informants (Creswell, 1994).

Consistent with the emergent and exploratory nature of qualitative inquiry, overarching guiding questions prevented setting limitations on the inquiry. By posing questions that are non-directional, the researcher created an environment within which the informants’ were free to relate their experiences. No preconceived expectations were forced on the interviewees’ background in and awareness of brain-based learning. The purpose of this study was well suited to a qualitative design in that personal voices were heard and stories were told.

I drew on Patton’s (1990) list of ten qualitative research characteristics as a guide to direct my inquiry. These characteristics offered a road map to follow and benchmarks that gave direction to my exploration.

1. Naturalistic; my research occurred in a real world setting; lived experiences of foreign language teachers.
2. Inductive Analysis; beginning with a broad general research question, the researcher was immersed in the details and then inductively sought out the findings.
3. Holistic perspective; contrary to a quantitative approach, the researcher studied the whole phenomena, teacher experience, as it happened and not controlled for variables.

4. Qualitative data was characterized by thick, rich description, capturing the voices of the informants through their words in lengthy interviews.
5. Personal contact; the researcher was a participant observer and had direct contact with not only the participants but with the setting as well.
6. Dynamic systems; refers to an evolving process which pays attention to ongoing changes in the study.
7. Unique case orientation; each participant was unique and special and each voice was heard and given equal importance.
8. Context sensitivity; the context of the setting was critical from a social, historical, political, and educational viewpoint.
9. Empathic neutrality; complete objectivity was impossible; there exist multiple realities, however researcher used bracketing to set aside prejudgments.
10. Design flexibility; the research design was open to change and was inherent in a heuristic approach in discovery.

Participant and Site Selection

Qualitative studies rely on participants who are available and accessible (Fink, 1998). In this vein, exploratory discussions were held with faculty and researchers in the field of SLA and brain based teaching and learning. I targeted the following individuals for information on participant recruitment; Dr. Teresa Kennedy, from the University of Idaho who is currently director of the International Globe Project in Boulder, Colorado and has presented at several foreign language conferences on brain-based foreign

language instruction and has an accompanying website for L2 teachers, Dr. Robert Richburg and Dr. Jean Radin from Colorado State University with extensive teaching and research focus and background in brain-based teaching and learning. Miles and Huberman (1994) refer to this typology of sampling strategy as participant recommendation or referral. Of those mentioned above, Jean Radin and Teresa Kennedy identified persons of interest to my study.

In addition, a criterion sampling approach included a search conducted through the Colorado Congress of Foreign Language Teachers (CCFLT) list serve. Further snowball sampling was also used for participant recruitment. Rationale for selection was based on participants' familiarity with trends in teaching and learning based on brain compatible, brain- friendly or brain-based strategies and second language acquisition. I chose the CCFLT list serve because its members have access to conferences, workshops, professional development materials, and collegial networking which provide diverse venues and exposure to new theories.

Research participants consisted of seven foreign language teachers who were acquainted with brain-based teaching strategies, and who also teach within a k-12 environment. Purposeful sampling was used to identify teachers who meet the proposed criteria for this study (Table 3). The use of criterion sampling ensured that all cases met the same criterion and was also useful for quality assurance.

Table 3

Sampling and Data Collection Strategies

Purposeful (criterion) sampling

Strategy	Purpose	Data Sources
Criterion Sampling	All cases met criterion-experienced phenomenon	CCFLT list serve Faculty: Richburg, Radin Researcher: Kennedy

Data Collection Methods

Collection Method	Purpose	Sources
Interviews -unstructured, open-ended, note taking Designed interview protocol	Listened to the voices to gain understanding of phenomenon	L2 teachers
Reflection	Gained understanding and reflected on personal experiences and/or biases	Myself-

The sites for this study depended on the participants' school and home locations. These were located within the greater Denver, Fort Collins and Colorado Springs area. I chose this area of study for practical and logistical reasons stemming primarily from the researcher's physical proximity to the locations mentioned. In depth descriptions of the areas and locations of the study are addressed in Chapter 4.

Data Collection

The research design follows the following constructs.

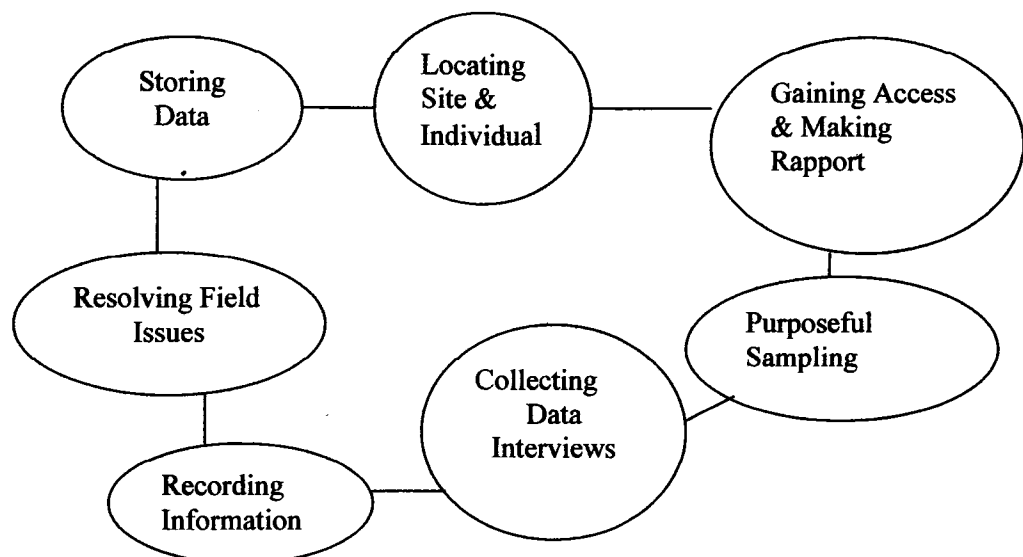
- 1.) The nature of brain based teaching and learning in general terms relevant to the literature and each teacher's individual experience.

2.) The experiences of L2 teachers who have incorporated strategies into their curriculum and lesson designs that reflect B-B criteria.

Figure 1 displays the collection activities in a general format (Creswell, 1998). The specifics surrounding the data collection activities and individual participant demographics are presented in detail in Chapter 4.

Figure 1

Data Collection Activities (Creswell, 1998)



Lengthy interviews, ranging from 45 minutes to one and one-half hours were conducted with the participants. Although initially considered as an option, no subsequent follow up observations in the classrooms were deemed necessary for further clarification. There was nothing from the interviews that justified the value of classroom observations. The depth and richness of the interviews provided sufficient data from

which emergent themes were apparent. Recurrent themes and ideas provided the needed saturation.

Protocols, seen in Table 4, were used as field note taking procedures to record interview information. The rights of the informants were protected through informed consent and human subjects' approval. Data consisted of detailed observational field notes, journaling, audio tapes, and transcripts of conversations.

Table 4

Interview Protocol

<p>Project: L2 Teacher's experiences with Brain-Based teaching and learning</p> <p>Time of Interview: Date: Place: Interviewer: Interviewee: Position of Interviewee: Language taught, grade level</p> <p>Description of Project:</p>
<p>Questions:</p> <ol style="list-style-type: none">1. What do you understand by the terms "brain-based teaching"?2. What do you understand by the terms "brain-based learning"?3. Tell me about your in-classroom experiences with B-B teaching and learning?4. How do you perceive these strategies affect student learning in your class?

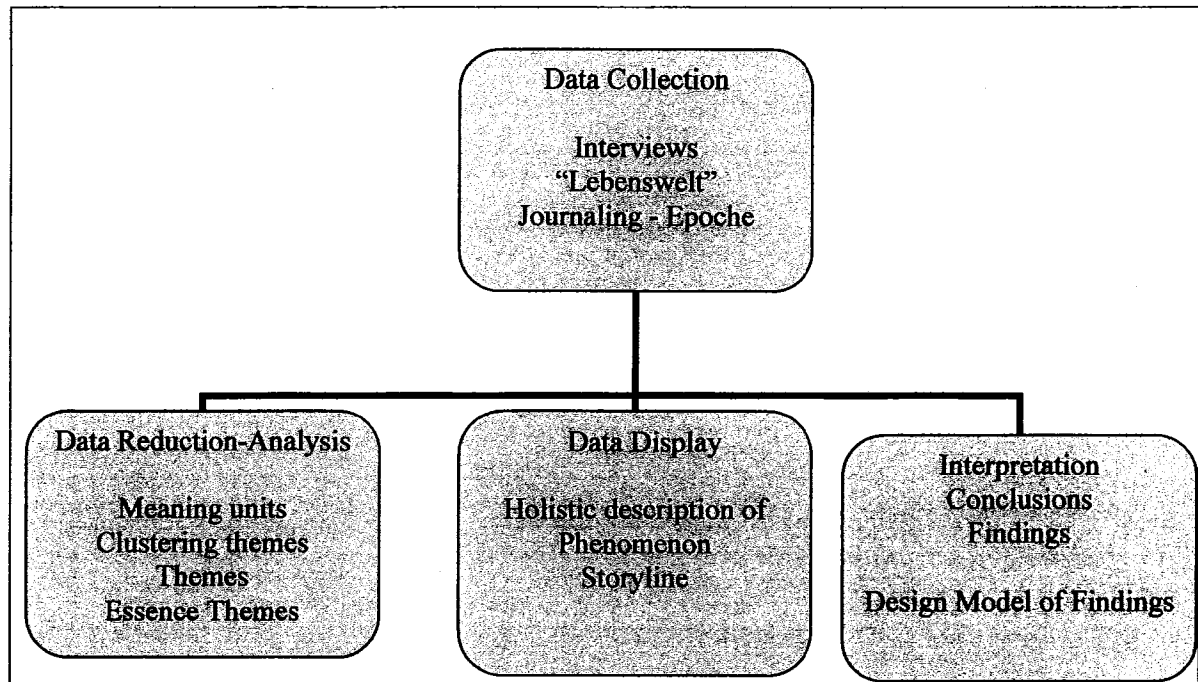
Data Analysis

The analysis process included collection, interpretations and narrative reporting. The interviews were professionally transcribed. Moustakas (1994) offers a structured process that guides phenomenological data analysis. Analysis steps, according to Moustakas include; horizontalizing individual statement, creating meaning units, clustering themes, advancing textural and structural descriptions in an exhaustive description of the essential invariant essence of the experience. This description becomes a storyline or picture that describes and captures the essence. Data was interpreted and reduced into patterns, categories, and themes from which a larger picture emerged. In depth descriptions of the themes are presented and described in Chapter 4.

Relying on tenants of the qualitative paradigm, the researcher sought out the 'Lebenswelt' of the participants to gain empathetic understanding or 'Verstehen' of their experiences (Miles & Huberman, 1994). Figure 2 provides a graphic view of the analysis strategy used which was to; conduct interviews, create and organize files for data; read through texts, make margin notes, form initial meaning units or codes; group meaning units into clusters (themes); develop an overall description of the experience, the essence of the experience; interpret findings and represent these in a model.

Figure 2

Analysis Strategy



By means of the data acquired from my interviews, I designed a model that represents a brain-based teaching and learning system. This graphic displays the essence of the phenomenon under study, supported by second language teacher pedagogy and student learning as experienced by the participants and linked to principles of brain-based teaching and learning. To arrive at this model, I prioritized variables centered on prominent themes and ideas taken from the transcribed interviews. The nature of the themes/concepts/words used and their frequency of use within the interview texts clarified and strengthened categories. Key themes were placed in gerund forms to support an active interpretation of meaning and provide further understanding of the phenomenon (Miles & Huberman, 1994).

Table 5 presents several tenets of learning which were categorized according to the recurrent gerunds that were identified from the data.

Table 5

Gerund Themes

Tenets	Gerunds
Learning through patterns --	patterning, sorting, chunking, cueing, pacing
Learning through repetition –	renewing, repeating, reworking, reinforcing, processing, modeling, automating, absorbing
Learning through emotion –	caring, craving, feeling, socializing, sensing, affecting, experiencing, activating, instilling
Learning through challenge –	motivating, engaging, challenging, instilling, acquiring
Learning through meaning –	connecting, conveying, contextualizing, integrating, relating, interweaving, internalizing, validating
Learning through action --	singing, drawing, storytelling, acting, jumping, talking, playing, doing
Learning through self-awareness --	learning strengths/weaknesses, self-discovering, feeling, assessing, monitoring

These tenets of learning were then clustered into themes which conveyed climate or environment, structures, concerns, unique needs, perspectives, responsibilities, ways of thinking, processes, meanings, and activities. The main research questions were then

revisited to determine how these clusters or categories were related and connected. From these connections essence themes emerged. Of paramount importance in this discovery was a rigorous and diligent journaling process that included a comprehensive back and forth review of these active meaning units and themes from interview texts to notes and back again, never losing sight of the main research questions. Lists and hand drawn graphics were then produced to further determine and visualize possible connections and overarching concepts that strengthened the analysis and produced ten essence themes.

Ultimately distinctive and shared features emerged that aimed at discovering the invariant structure or true essence that clearly identified, linked and typified the foreign language teachers' experiences.

Verification

Disciplined inquiry necessitates procedures for determining authenticity, a concept relating to validity and reliability addressed in quantitative research. Roberts (2004) describes this as “the credibility factor” (p. 145). The sense of credibility provides trust to the study. Qualitative researchers use the term trustworthiness as an indicator of quality and disciplined inquiry. A practice of comprehensiveness, transparency and reflexivity throughout the inquiry process provides vigor and clarity which lends authentication to the concept of trustworthiness. Detailed and meticulous note taking, journaling, constant comparison and a checking and rechecking of the narratives led to a formulation of *in vivo* themes, giving authentic voice to the study. Moustakas (1990) refers to this as “constant appraisal of significance”. Then in order to understand the

experiences of the participant foreign language teachers in as rigorous and detailed manner as possible, the concepts and themes were linked to brain-based teaching and learning principles supported in the literature to further support consistency. Creswell maintains that, “objectivity and truthfulness are critical...the criteria for judging a qualitative study: the researcher seeks believability based on coherence, insight, and instrumental utility and trustworthiness through a process of verification rather than through traditional validity and reliability measures” (Creswell, 1998, p. 163).

Reflexivity calls upon a disclosure of the researcher’s illumination and own awareness as meaning interpreter and meaning maker. Willig (2001, p. 10) refers to this as the researcher’s “impossibility of remaining outside one’s subject matter while conducting research”. The role of researcher necessitates engaged involvement and self-honesty, critical to qualitative research. Through personal reflection and language awareness, the researcher remained transparent and ethical throughout the inquiry process.

Furthermore, Creswell (1998) concludes that “in a phenomenology the outcome typically consists of a descriptive narrative, a synthesis of knowledge about the phenomenon under study” (p. 160). I drafted a hybrid model that reflects the synthesis of knowledge and supports my findings. Fink (1998, p. 147-150) also provides a checklist to monitor the quality of qualitative research as follows.

Checklist:

- Data collection methods must be reliable and valid and accompanied by supporting evidence of their accuracy. Participant observations in which the investigator becomes participant in the group being studied.

Researcher met with each participant in either a school or home setting and conducted a face to face interview. The interviews were tape recorded and professionally transcribed to provide accuracy.

- The study should contain proof of a rigorous research design. Use of several methods or reliance on several perspectives, theories, or traditions underscores the exacting nature of this approach.

The researcher provided a clear explanation and rationale for a qualitative research design supported by several examples in the literature by noted authors in the field. Analytical rigor, comprehensiveness of coverage and transparency support the quality of the study.

- Sound sampling methods should be demonstrated. Criterion sampling can strengthen the link between the subjects chosen and the nature of the inquiry.

Criterion sampling was used for participant selection.

- Investigator should describe their traditions of inquiry and research perspectives. In a phenomenological inquiry the researcher's relationship to or commonality with the participants may bolster the quality of the research.

Before I engaged in this research study, I was clear as to my biases as a foreign language teacher.

- Analysis methods must be carefully explained. Since qualitative interviewing produces large amount of data it is critical to organize and categorize data with a meticulous methodology as a guiding force. A synthesis of the data into a model/matrix or visual representation offers further quality to the research. A transcriber will be used to transcribe interview audiotapes to increase reliability of the study.

Figure 3 in chapter 4 offers an overview of the organization and categorization of the predominant concepts and themes. Figure 4 illustrates a synthesis of the data into a model that provides a visual representation to understand the essence of the phenomenon.

A professional transcriber was used to transcribe the audio taped interviews.

Ultimately "the question of validity is one of meaning" posits Moustakas (1990).

A rigorous and exhaustive heuristic search derived from meaningful dialogues with the participants led to the essence of the experience.

Limitations

“The phenomenological report ends with the reader understanding better the essential invariant structure (or essence) of the experience, recognizing that a single unifying meaning of the experience exists....the reader should come away understanding what it is like for herself to experience that” (Creswell, 1998, p. 55).

Ultimately it was from the voices of those in the know, those who lived the experience, that I gained insight into the phenomenon. The essence and meaning rested within the experiences of teachers and through their personal dialogue.

CHAPTER IV

FINDINGS

The focus of this chapter is the presentation of qualitative data. This chapter provides a description of the context of the phenomenon, demographics collected from the participants, stories for each participant in the study, themes related to understanding the phenomenon, and themes that describe the essence of the phenomenon. To support the themes, I provide specific examples using direct quotes from the participants. A brief summary of the essence is presented at the end of the chapter.

Context of Phenomenon

The ways in which human beings gain knowledge of the world around them is the focus of a phenomenological study (Willig, 2001). Miles and Huberman (1994) refer to this knowledge of the world around us as “Lebenswelt”. To interpret this “welt” the phenomenologist enters on a heuristic journey to uncover the essence of an account, “...what is constant in a person’s life across its manifold variations” (p. 8). On this quest for knowledge, the researcher becomes investigator and part participant in unraveling the essence from data that are disorganized and complex.

Data represented in lengthy interview transcripts, unstructured notes and personal texts provide a daunting challenge for the researcher. In this investigation the researcher becomes a “...cerebral detective, ferreting out answers to research questions” (p. 29). To

this end the analysis of the data results in a careful and systematic reduction process. Through structural and textural descriptions, the researcher notes down “what” was experienced, offering the reader a description of the meaning the participants have experienced. The ultimate goal of interpretative phenomenological analysis, according to Willig (2001), is “to capture the quality and texture of the participants’ experience” (p. 53).

This study, in particular, aims at first listening to the voices of foreign language teachers as they explain their understanding of and experience with brain-based teaching and learning and how brain-based affects learning. Then, explores how the researcher’s personal knowledge, was affected by the study and offers insight through a “...creative close that speaks to the essence of the study and its inspiration to [me] in terms of the value of the knowledge and future directions of [my] professional-personal life” (Moustakas, 1994, p. 184).

Demographics

The purpose of this study was to obtain verbal descriptions from L2 teachers of their experience with brain-based teaching and learning and its affect on students in their classrooms. I interviewed seven foreign language teachers throughout the state of Colorado (see Table 1). I traveled from Fort Collins to Colorado Springs to interview my participants. The teachers I met taught different foreign languages (French, German, Spanish), at different levels of instruction (Middle School through Adult), and at both public and private institutions. Their overall foreign language teaching experience averages twelve plus years and their understanding and experience with brain-based

teaching and learning varied from a “little” knowledge to brain-friendly advocates. Interviews were held in classrooms, offices, private homes, and a public library. Interview lengths ranged from forty-five minutes to one and one-half hours. Over one hundred and seventy pages of transcription were produced from the interviews. Teachers are identified by letters, A through G to protect anonymity.

Professional, thoughtful, engaging and willing to share their thoughts and experiences, these teachers offered me a rare opportunity to participate in their worlds. Several mentioned that they were excited to participate in my research in hopes that this study may influence future statewide foreign language curriculum development and policy.

Table 6 places the interviewees' demographics in an organized format to enhance understanding by providing a visual presentation along with the text. The following table includes the participants, the grade and language they teach and years teaching that language, and their current school level.

Table 6

Participant Demographics

Teachers	Grade	Language/Years Taught	School Level
A	9 th – 12 th	French/ 14 yrs.	High School
B	9 th – Adult	Spanish/15 yrs.	Community College
C	7 th – 9 th	German/17 yrs.	Junior High School
D	7 th – 9 th	Spanish/12 yrs.	Junior High School
E	6 th – 8 th	Spanish/12 yrs.	Middle School
F	6 th – 8 th	Spanish/12 yrs.	Middle School
G	9 th – 12 th	French/6 yrs.	High School

Teacher A – Story

Teacher A has taught French for over fourteen years, most recently at the high school level where she teaches students in grades nine through twelve. She also has a background in theater and information technology. I interviewed Teacher A at a public library in a conference meeting room since school was not in session. Due to the location of this particular interview I can not comment on the physical environment of the classroom setting.

Teacher A has a background in brain-based theory based on college courses taken specifically and through texts by brain-based authors. "... a few courses at a local State College and reading the book, *Teaching with the Brain in Mind* by Eric Jensen." She mentions that her knowledge of brain-based theory is fairly general in nature and not directly associated with second language or foreign language acquisition. "I have not seen any foreign language specific things on brain-based findings." Teacher A discussed the importance of novelty and alertness in respect to how the brain is receptive to learning. "...the brain creates novelty and so walking around the classroom is a good thing, by tying that into brain research about how the sound bouncing off the walls differently, the different locations visually of the teacher can increase alertness...it makes the brain more receptive." She believes that memory is enhanced by acquiring knowledge in "chunks" and how to "chunk repetition". Teacher A is playing with new ideas to increase information retention and specifically student alertness. "Peppermints in class and I explained to students the research on peppermints [how activating] the senses affects learning". With the mint analogy Teacher A also emphasized the importance of a teacher who cares for her students. "I'm a teacher that cares about them and I'm a teacher that wants them to be successful".

As a high school teacher she understands how critical it is to reach all of her students. "I need to be on my toes every minute and try to come up with every strategy I can to get past the baggage they [the students] bring into the classroom". She also places a high value on sharing her knowledge with her students. "I share with the students about how the brain learns". She discusses how motivation, challenge, and feedback are critical to learning and how these relate to how the brain processes information. Her "biggest

enemy” is student apathy. Other teachers complain of behavioral issues, however Teacher A finds that using brain-based strategies motivates not only her students but herself as well. “...what I found with these strategies [I’m] making me come more alive. Me more passionate, giving me more...there is always a way to do better”. She describes how being better requires “new tools” to approach changing student needs. When students receive too much material at once their brains shut down and panic sets in.

There is a fine line between challenge and threat. The concept of “less is more” is especially critical when it leads to automaticity. “More is not always better, better is better”. More research is needed in how best to teach a foreign language.

Teacher B – Story

Teacher B has taught over twenty years the last fifteen in a formal classroom setting. Besides tutoring Spanish and English composition in previous years, Teacher B has taught Spanish language to Middle School, High School, and adult learners in public and private institutions. She currently teaches at a Community College where she also taught secondary students through an online TV shooting to outlying counties in Colorado. Our interview took place in her home office.

Teacher B discussed brain-based teaching in terms of understanding brain hemisphericity. “..doing brain-based teaching is getting for instance the left and right hemispheres talking to each other...while working with as many modalities as possible”. To reach all students she believes you need to address modalities while not “overloading the table of information.” This metaphor comes from a workshop she attended at the CCFLT conference presented by Dr. Teresa Kennedy. Teacher B discussed the

difference Dr. Kennedy's presentation made on her own perceptions of learning. Most of the information at conferences seems to be repetitive or common knowledge while this workshop was unique and relevant. Teacher B took to heart the importance placed on information overload, relevance and emotion. "Ok, I can go do this".

Student responsibility for learning is critical as well she stated. Brain-based learning "...is when students take advantage of their learning styles so that they are efficient learners, so that they are using a set of review methods." She views her role as teacher facilitator.

In classroom experiences for Teacher B focus on addressing the power of limbic system while offering visual, auditory and kinesthetic activities. She believes that if the limbic system responds negatively, nothing "gets through to the rest of the brain". Focus is on "fun not fear" and avoiding "student panic". She emphasized the importance of a relaxed atmosphere that is interdisciplinary. The notion of presenting "chunks" of material, "bit by bit" is crucial in setting a non-threatening tone for learning. "I try to make it a step by step process to that again it reduces the amount of panic." She refers to these chunks of information as "patterns" which become permanent "file drawers" in you brain from which a learner can retrieve information to build on new information. These patterns are similar to a "pass" so that a learner can recover information. Color coding is an example of a "pass" that sets up a pathway for the brain to know which file drawer to go to.

Teacher B expressed frustration that curriculum development and school policy is not informed by the current research on brain-based teaching and learning. There exists a marked difference between "memorization of language and internalization of language".

Schools are focusing on the memorization aspect "...ramming it [language] down their throats, they [students] have no time to process anything...and are in a constant panic". She is frustrated with current policies with foreign language instruction that still follow traditional instructional guidelines. Teacher B believes that by adopting brain-based principles, " they are happier students; they want to come back...you learn a lot...I don't think you lose any academic rigor by having fun and by encouraging your students to have fun".

In assessing brain-based learning, Teacher B recognizes the importance and power of understanding how our brains work and how learning is a process of making connections. " ...this is not just a foreign language thing, this is a brain thing, this is how your brain functions and you need to be friends with your brain."

Teacher C – Story

Teacher C has taught German for over sixteen years. The last nine years she has taught students at the junior high school level. I had the pleasure of interviewing Teacher C in her classroom. Posters, pictures, props, costumes, hats, wigs, colored bins full of pens, crayons, scissors, markers, rulers, and an upright piano adorned the classroom. I felt the energy of student activities even without the students' presence. Cultural realia oozed from everywhere and yet it was not overwhelming. I found it necessary and appropriate for a foreign language classroom. I could feel the energy of students.

Teacher C first heard the terms brain-based teaching and learning during a workshop offered at her school and presented by Dr. Bob Richburg. She had no previous knowledge of brain-based theory prior to this workshop. She defines brain-based

teaching as “how the brain works”. More specifically she says how the brain retains information, how it “gets interested in subjects”. This research has been translated into specific strategies that facilitate learning. She believes that many of the activities that she does in her classroom fall into brain-based strategies. “I found fascination that I was already doing a lot of these things before I knew about the research”. She mentions the importance of being “eclectic”. Music, acting, field trips, jumping rope, are a few of the activities that Teach C falls under brain-based umbrella. Repetition and reworking material also facilitate retention. The element of surprise intrigues students and focuses their attention. “...surprise the kids, try to get them to figure out why you’re doing what you’re doing...”. She believes associations are strong elements that help with memory retention. “...today we were kicking a ball because that was going to demonstrate verb kickers, subordinate conjunction and during the activity one of the kids said; ‘and I’m sure you’re going to let us figure out why we’re doing this, aren’t you?’”. She places a strong emphasis on students asking “why” to challenge their thinking. However she is also conscious of not overloading them “...you don’t want to overwhelm them but you want them to hear the language as much as possible”. Teacher C is careful to point out that “you can’t do anything too much”. There is a time to change focus and move on and she believes the teacher needs to pace activities so that students are not overloaded and/or overwhelmed.

Learner attention and memory retention are critical in learning. “If we can get their [students] attention, grab their attention and keep it, I mean that’s what’s important”. She knows that her students are learning when she “sees the kids engaged and when I see them happy to be in class, when they tell me this is one of their favorite classes, when

older kids come back to visit, all those connections tell me that the right things are going on”.

Teacher C closes our interview on a self-reflective note as we discussed how brain-based teaching will affect her classes in the future. “...what it has done for me is it has validated things that I do naturally...now I feel good about taking kids to the drinking fountain and calling it a field trip...because I know it works and the research tells us that it’s OK to do things that used to be considered off the wall”. Teacher C also relies on the support of her administrator and realizes that she is fortunate to teach in a school that recognizes the importance of an eclectic approach to teaching.

Teacher D – Story

Teacher D also teaches at a junior high school. She has taught a total of fifteen years, twelve of those as a Spanish teacher. Being able to meet in her classroom provided the interview a rich background setting. Student work and photographs covered the walls. Authentic posters and cultural realia enriched the visual environment by creating a Spanish world within the school. During our interview students stopped by for some extra help, which Teacher D gladly provided.

Teacher D’s background on brain-based teaching learning centered on readings on dendrites in the brain and workshops offered by her school. She believes that how you teach a foreign language is compatible with dendritic development. This development is related to how the brain functions. “...the brain functions in certain ways that make teaching more effective...it’s a natural process”. Teacher D stated that “...teaching a foreign language is a very physical, hands on, involved process”. “Doing” the language

promotes this development in the brain. She also believes that the current state standards for foreign language provide a framework for learners to “actually do something with the language”. However, she is frustrated that the system, specifically at the high school level does not recognize the importance of learning naturally, that is to say, foreign language teachers still use “grammar drills” in their instruction.

Teacher D sees the connection between teaching and learning as such; “...the way I teach students...to help them learn better”. The other side of the same coin is how “kids learn” which she emphasizes is concerned with learning styles. Her teaching style already reinforced brain-based strategies to accommodate her students’ diverse styles. Teacher and student knowledge of brain functioning is necessary to be more effective in the classroom. Understanding that learning is a life tool is critical to success. Meaningful contexts offer students background and framework for them to connect short term memory to long term memory. She believes that using activities, such as TPRS, while difficult for the teacher to prepare, are extremely successful in strengthening student language proficiency. The idea of picture “chunking” material in a story line script works well for her students. “It’s easy for them and they ace it and they feel great”. What she views as best teaching and learning practices for students does not agree with what the district requires however and she feels frustrated. She works diligently to accommodate curriculum demands while offering her student an eclectic repertoire of teaching and learning strategies.

In conclusion, Teacher D is quick to say that the validation of what she is already doing and experiencing in her classes is rewarding. Encouraged by her students’ success

she believes that further research is yet needed to influence current policies that are not directed to “what is best for kids”.

Teacher E – Story

Teacher E has taught foreign language for twelve years. She currently teaches Spanish to middle school students. She previously taught French as well. We met in her office adjacent to her classroom.

While Teacher E begins our interview by admitting she is not too familiar with brain-based teaching and learning, she nevertheless explains how it means “...teaching in a way that will best engage a student’s brain function”. She adds that “neurons firing” allows information to “stick a little better in their [students’] brains”. Teacher E equates kinesthetic learning as a means to activate this firing of neurons. She also mentions TPR and its extension to TPRS (Teaching Proficiency Reading and Storytelling) as a method of such kinesthetic learning. Contextual learning she imagines is brain-based in that actions and words connect to form meaning. She also mentions workshops she attended that focused on TPRS. Her students benefit tremendously from this type of instruction.

Teacher E also connects teaching to learning in that students, at the receiving end need to have information presented to them in such a way that “...to get the brain to make those connections...and make the information more permanent or more retrievable”. She finds it difficult to separate the teaching from the learning “They are so interconnected I just don’t know how to pull it [learning] out of there”.

Kinesthetic learning she describes as action based and extremely valuable however a “foolishness” component provides the memorable edge. Vocabulary that

makes middle schoolers laugh and giggle, retelling a story learned the wrong way by adding hilarious details, such as “vomit” or “zit”. Students are engaged and wrapped in the story. The teacher also enjoys teaching in this atmosphere; “...students are eager to participate and it’s so much more fun to teach”.

Teacher E reflects on how language learning is by definition a brain friendly activity. She compares her own two year old son’s natural eagerness to learn new words to her students who ‘...just want to suck it all up”. She finds that these similarities support a natural language learning process that is reinforced by context, actions, repetitions, pace, and playfulness. Effective learning she believes allows students to “soak up things” at a certain pace. She is amazed at how well her students speak given the appropriate guidance. Giving students long lists of vocabulary, as other colleagues do is brutal. Students need appropriate context and time to absorb them.

In conclusion, Teacher E states “I don’t know how I would teach any other way again...I would be so bored and frustrated trying to get my students interested”. She mentions that she is fortunate to not only have a mentor in her department but an administration that supports her teaching methods as well.

Teacher F – Story

Teacher F has taught both French and Spanish for over 12 years. For the last nine years she has taught Spanish to middle school students at her current location. We met in her classroom which provided a rich backdrop of student work, decorative posters, maps, language charts, art supplies, and contextual and cultural specific realia of every sort.

Whereas she is not very familiar with the terms brain-based teaching, she understands that it has to do with teaching and learning that “activates certain parts of your brain that are used for various functions and addresses those specifically”. Teacher F’s perception of brain-based learning is best described by her as “...the way that you interpret material or the parts of the brain that you use for the tasks you are given by your teacher”. The receiving end of the learning process as opposed to the presenting of information and tasks which she describes as “teacher generated”.

Her in classroom examples of brain based activities are centered on contextual delivery of language. Specifically she refers to TPRS as her preferred mode of instruction. With this process students receive whole language instruction with repetition. Teacher F emphasizes the important of “lots of input...lots of repetitive input”. She explains that her students are able to absorb the material “pretty easily” with this method of delivery. While some students understand grammar easily and quickly, she states that many more don’t make the necessary connections and using TPRS for example offers a more “creative and expressive” way to learn.

One activity that Teacher F finds successful with most students is, after presenting the story line, offer a perspective change. She changes the persons and perspective of the story and as she changes characters the grammar changes as well. Students are still thinking in terms of meaning. This focus on meaning allows the students to manipulate the grammatical structures without rote memorization. Thinking in terms of meaning and presenting a few new concepts at a time allows for better retention.

Additionally, meaning must be personal and personal for middle schoolers may include some silliness. “They [students] love to be goofy and silly. They love to get up

and act something out”. She believes that the prior emphasis on vocabulary and grammar drills present words and concepts in “isolation” without any meaningful attachment. She suggests using current media, TV shows, news articles, etc. as “springboards” for discussion and authentic input. Teacher F sees rote memorization as temporary and “not long lasting”. To truly acquire language, she maintains, a deeper learning process is necessary that activates the brain. This deeper process involves emotion, context, movement, songs, and doing things that are bizarre and exaggerated. She witnesses how these help her students retain language. Consequently, via these brain friendly methods, Teacher F also recognizes higher achievement in students’ language skills. “More and more kids are experiencing success”.

In conclusion, Teacher F reflects on her own teaching two years ago. She feels more connected to her students and they enjoy Spanish so much more. The language is meaningful and purposeful for them and they can “do it”. She believes that “The idea of what you are learning [should be] meaningful to you in some way, [be] personal, [be] emotional, and all of that could be very relevant”. Her students love the language.

Teacher G – Story

My last participant has taught foreign languages for over six years. Teacher G’s second language background encompasses French, German, and Norwegian languages as well as studies in second language acquisition (SLA) and English as a second language (ESL). She currently teaches four different levels of French at the high school level. She has held this position for one year. Prior employment included teaching English to students abroad. We conducted our interview in her classroom. Again I found an

environment rich with posters, maps, overheads, flags, menus, postcards and of course student work. When I arrived class was still in session and I observed students engaged in finishing up group activities in different corners of the room.

Teacher G's prior knowledge of the terms brain-based stem from her participation in a workshop at a CCFLT conference. However she has not taken any specific courses in brain-based teaching and learning. She interprets brain-based teaching as teacher heightened awareness of diverse learner skills. A teacher views a student as an "affective learner". Understanding that students learn differently, especially based on different modalities, such "as visual, auditory and kinesthetic" a teacher can be more effective. It is the teacher's responsibility to address diverse needs of students. "I think it's teaching to students based on their needs".

In addition to the different modalities, Teacher G includes understanding a learner's strengths and weaknesses as a component of learning. Brain-based learning she states is "...aiming your classes towards the different learning styles of the students and then...their strengths and weaknesses" as witnessed through their work. Offering a questionnaire to students at the beginning of the year can provide a teacher with valuable information on how the students see themselves as a learner. She has found this quite helpful in offering an initial profile of her students. Furthermore, Teacher G connects brain-based learning with differentiated instruction. By an eclectic approach to instruction she refers to "mixing up a lot of different strategies...just being able to touch on every base helps students". She also mentioned a choice option for her students so that they are given an opportunity to focus on their own personal style of learning. For

example some students stronger in writing skills are not required to write out their dialogues while others need to focus on their spelling.

While Teacher G supports a differentiated approach, she is constrained by the curriculum and the text. She teaches four levels of French and must focus on student articulation from one level to the next. This she refers to as “getting through the chapters”. Using more eclectic forms of instruction, such as TPRS, she states does not provide her enough flexibility to cover the district required material. However given an option of less structure from the district she would be using TPRS for example much more. “I think it [TPRS] is easier to use if you are not bound to a curriculum”. She recounts her frustration with the district and its approach to changing texts. Her current materials for example propose to “spiral” language however she feels that the texts simply introduce something without sufficient culturally connected and related activities that support reinforcing prior language. “It [the text] doesn’t repeat it very much and the kids get confused”. Without this spiraling or repetition of material she sees some students “...getting lost in the shuffle of things.” The notion of repetition in language learning, she says, is connected to how the brain processes material.

For affect on student learning Teacher G speaks to countering boredom and apathy as a critical component. She describes how the four skills areas of SLA, speaking, listening, reading and writing offer a differential approach to learning. “...using the four skill areas of foreign languages makes them [students] able to speak, write, and read and be able to comprehend what they are listening to. It also keeps students from being bored on just one activity”. Unfortunately she continues with a class of 25 students it is difficult to “get enough oral practice...it is just so hard when you’re in a class with so

many kids”. Her frustration with class size, lack of time for sufficient oral language practice, and student apathy result in hindered process and success for many students.

In conclusion, Teacher G recognizes that individual attention to student learning is critical. She focuses on the importance of understanding students’ needs as well as their strengths and weaknesses. She speaks to the importance of repetition in second language learning and to the emotional engagement of her students. While she feels that some students are “lazy and don’t want to speak”, she also realizes that some “don’t feel comfortable using the language”. It is this discomfort which she associates with fear. “Sometimes there are kids who won’t present anything, because they’re too shy or they don’t think they know”. She finds herself frustrated with how to help these students and would like to learn more about brain based teaching and learning to acquire more strategies for classroom use.

Themes for understanding the phenomenon

In each of the interviews participants discussed and reflected on teaching and learning as seen through a brain compatible lens. This perspective provided insight into their experience as foreign language teachers. In analyzing the data from my interviews ten themes emerged from the four main research questions. Each cluster of themes is given a name that reflects its essence. Each theme is introduced and then described through direct quotes from the teacher participants to support the findings. To supplement the narrative format, Table 7 provides a summary of the research questions and the associated themes.

Table 7

Emergent Themes

Research Questions	Emergent Themes
What do you understand by the terms “brain-based teaching”?	How learning happens Teacher responsibility
What do you understand by the Terms “brain-based learning”?	Connecting teaching and learning Learner responsibility
Tell me about your in-classroom experiences with B-B teaching and learning.	Active learning Internalizing learning
How do you perceive these strategies affect student learning in your class?	Countering student apathy Fun versus Fear Instilling love of language Promoting success

In response to the first research question, the foreign language teachers overwhelmingly connected teaching to a process in which brain function and teacher knowledge of that process play key roles. While a student experiences varied methods of instruction, how the instruction is linked to learning and subsequently internalized and stored for future use, lies within the complexity of neural connections and the method of instruction. The following two themes emerged from research question number one; what do you understand by the terms brain-based teaching? The themes are: How learning happens and teacher responsibility.

How learning happens and teacher responsibility

This first theme centers around teaching as viewed through a brain-based lens. The teachers interviewed overwhelmingly related teaching to a process that helps students learn. To this end, knowledge of how the brain functions may then be applied to practice as described in the following quotes.

Taking the most recent knowledge about brain research and how the brain functions and then trying to apply that as best as one can, given the limitations of a classroom setting. To help students learn better. (Teacher A)

In brain-based teaching you are kind of looking at getting left and right [brain] hemispheres talking to one another and that you address this system so that information can get through to all that you are trying to work with as many modalities as possible so that you reach as many students as possible. (Teacher B)

There has been a lot of recent research into specifically how the brain works, how it learns, how it retains information, and how it gets interested in subjects. By taking the information from this research that these professionals have done into how the brain works and translate that into specific strategies that facilitate learning better. (Teacher C)

The second theme, emerging from question one, addressed teacher responsibility. This responsibility lies in acquiring the necessary knowledge or skills to better understand the learning process which in turn facilitates student learning. In essence how to be a more effective teacher and apply this knowledge to classroom practice, these teachers understood the importance of brain function and its direct relationship to reaching all students. Several teachers expressed a sense of duty and import in understanding students' diverse learning needs and addressing these needs through application of this knowledge in the classroom.

The brain functions in certain ways and there are good ways to teach and bad ways to teach, ways that work and make the teaching more effective and there are other ways that are counterproductive to how a person learns. (Teacher D)

Teaching in a way that will best engage a student's brain function, so that it actually get the neurons firing and get information to stick a little better in their brain. I picture the brain firing to make connections. (Teacher E)

It has to do with learning and teaching that activates certain parts of your brain that are used for various functions and addressing those specifically. (Teacher F)

I think it's teaching to students based on their needs. The affective learner, based on whether they are visual, auditory, or kinesthetic learners. (Teacher G)

Connecting teaching and learning

The interconnection between teaching and learning emerged from the second research question, what do you understand by brain-based learning? While several teachers referred to the learning end as the "student's role, or the student's point of view", it was nevertheless quite evident that the connection between the teacher and student roles were well pronounced and necessarily blended together. Facilitating learning through a teacher/learner dialogue and connection is evident in the following quotes.

I would suppose the same sort of thing [knowledge of brain function] from the student's point of view. [However] I don't just try something on them, but I discuss it with them. I was just in class and I've learned this about you and about me and that has created a whole different dialogue with them. (Teacher A)

That's the student's job...I try to facilitate [their] learning. (Teacher B)

I don't know enough about it [brain-based learning] to articulate a huge difference other than to me if I look at learning it would be on the students and teaching would be on my end, so that the teacher would come up with the strategies to facilitate the learning on the student's end of the experience. (Teacher C)

Brain-based learning is the other side of the coin, how kids learn. The way I teach I'm always thinking that's how one learns better. They [teaching and learning] are connected. (Teacher D)

Brain-based learning is aiming class instruction toward the different learning styles of the students. Understanding their strengths and weaknesses such as whether a student is an auditory, visual, or kinesthetic learning as an example. (Teacher G)

Teacher E takes this theme even deeper and offers a parallel between what occurs within the brain, the neural connections, to that which occurs outside, the information and activities provided by the teacher to the learner.

Instead of brain-based teaching you would present your material in such a way to get the brain to make some of those connections and so in brain-based learning you would hope that the kids are receiving that information or doing the activities in such a way as to make those connections and make the information more permanent and more retrievable. (Teacher E)

Learner responsibility

In addition to the above mentioned bond between teacher and learner, the responsibility of the learner was an integral part of an effective teaching/learning process. One aspect was described by participants as the student's role, the student's end, the learner's job or the receiving end.

It's the other side of the coin. Kids have different learning styles and they learn more by hands on, visual, acting, involvement and that kind of thing. (Teacher D)

It's the receiving end, I would say, so instead of brain based teaching you would be trying to present your material in such a way to, you know, to get their brains to make some of those connections and so brain based learning you would hope that the kids are receiving that information or doing the activities in such a way as to make those connections and make the information more permanent or more retrievable. (Teacher E)

While these remarks may presuppose that a learner is passive in receiving information, the importance of self-awareness, ownership of self, and meta-cognition was included and deemed significant in providing students with information on how they learn best.

I would suppose the same sort of thing from the student's point of view, but with the students having greater awareness of how their own brain functions and how they best learn in taking some ownership. Some of the things I've learned in courses I share with my students for example how the brain learns or about how the amygdala is so much larger than when they are older. (Teacher A)

Ownership of learning for example demands that a student not only understand how a brain functions but how to use this information to help recognize one's own learning style. Taking advantage of this knowledge, the learner can train her/his brain to become more learner effective.

Brain-based learning is when students take advantage of their learning style so that They are efficient learners, so that they are using a set of review methods as part of a meta-cognitive process. You need to train your brain how to find information. Everyone is unique and people need to understand that about themselves...and a big part of our job [as teachers] is teaching kids really to recognize how they learn best and what is most ineffective, to separate those things out and avoid the ineffective when at all possible. I think that just like you need a drivers license to drive a car, you have to learn about how the car works and what the rules of the road are. I think that students need some sort of license to drive their brain if they are going to use it in a way that is effective...by increasing the efficiency of what they are doing...and this is not just a foreign language thing, this is a brain thing, this is how your brain functions and you need to be friends with your brain. You need to listen to your brain, you need to talk to your brain. (Teacher B)

Brain-basef learning is the way that you [as a learner] interpret material or the parts of the brain that you use for the tasks given you. (Teacher F)

Active learning/Internalizing learning

My third research question elicited the most data of any question. The teachers interviewed were eager to share their many and diverse classroom experiences using brain-friendly strategies and activities. Words used to describe these were: memory retention, chunking, repetition, relevance, action, contextual, useful, life-tool, connection, not in isolation, no overload, novelty, surprising, silly, foolish, unusual, flexible and eclectic.

From this research question two predominant themes emerged from the data; active learning and internalizing learning. These themes encompassed processes of relating, retaining and pacing of material with positive emotional involvement of the learner as central to these processes.

I'm a teacher that believes in them [students] and a lot of the brain research is saying that you don't just learn through your brain, that you learn through all of our senses and our emotions. My biggest enemy is apathy in kids and so what I found with brain-based strategies is they make me come alive...make me more passionate, giving me more as well. Giving me this new tool to approach how I design my instruction and exciting and that excitement then carries over [to the students] which helps in their motivation. Memory and chunking is a tool I've done a lot with trying to give concrete models to the students about how to approach studying vocabulary. I used to give them these huge lessons and say learn this for the test...now I spend a lot more time showing them how to learn the vocabulary and how to chunk it into a reasonable size, how to check to see if they are truly understanding it, before going on to the next manageable chunk. This is based on the research on short term and long term memory. I realized that a student could go home and study for twenty minutes and not remember any of it the next day, because of how they had studied it. By giving each word ten or fifteen seconds, putting them into short term memory and then going back and doing the same thing in multiple times with a list of fifty words, which is not uncommon. The strategies for repetition and novelty are very important...novelty, challenge, and feedback. I am also giving a lot more mini quizzes in little seven or ten question quizzes and then if you fail it, then we would redo it the next day. I make them go back and do it again...and then get instant feedback and so that does tie into some of the brain research is that instant feedback. The chunking, the examples, the modeling, the feedback loop, and making connections. Some kids will make those connections themselves and others need it to be explained to them and I probably metaphor my poor kids to death. But I would like automaticity within a very limited number of words and recognition for a huge number of words. Less is more, more is not always better, better is better.
(Teacher A)

The concept of 'less is more' was viewed as critical to second language acquisition.

The brain can only absorb so much information at a time and the "chunking" process allows for this absorption or internalization to occur at a more efficient natural pace.

The significance of context as structure and setting for effective learning was critical for student engagement and retention. This context embraced active learning through a wide range of activities that ultimately engaged students both physically and mentally as they absorbed new knowledge. Individual motivation underscored this type of instruction. Teachers focused on how to hook their students not only through lively activities but also by sparking their

curiosity. This process required that the context of the activities be meaningful for the students and again at a pace that did not overwhelm them. Words used by the following teachers to describe this process were: memory, chunking, retention, repetition, relevance, action, contextual, useful, life-tool, connection, not in isolation, no overload, novelty, surprising, silly, foolish, unusual, flexible and eclectic.

What I remember from Teresa (Kennedy) had to do with repetition and how to really be able to internalize a single word it took something like forty to eighty repetitions of the single word. Oh my God, you know how does one do that? At the same rate trying to deal with my kinesthetic learners, my visual learners, my auditory learners, I had to figure out a way to do it and so one of the things that I like to do is, I don't let my students open their books so their visuals come from me and usually we start off with a kinesthetic activity. Why, because it's fun and it's silly...I try to address their limbic system and get them to relax about being there. We'll do some sort of physical activity and then I put words on the board for the visual learners and anything I do I do in multi color. I'm big into color coding because that's how I remember things. In the meantime it's all auditory as well. It's never strictly auditory because that puts almost everybody into a panic and I try to avoid panic at all costs. I reintroduce material, add one more sentence...so it's almost like rehearsal time with the vocabulary...I make it relevant...and I try again to do it in steps. I try to make it a step by step process so that again it reduces the amount of panic. I don't think you lose any academic rigor by having fun and by encouraging your students to have fun...we remember things that are funny and we remember things that are important and we try to forget the rest. (Teacher B)

I wrote down a few strategies that I think are big to brain-based learning and what I found interesting is that I was doing a lot of these things before I know about the research...it was just strategies that worked and now they're brain-based strategies. We do storytelling, like TPRS. I'm really eclectic so I don't purely do any one thing. I do a lot of different strategies...storytelling is one where we take vocabulary and rework it again and again. The kids are the actors [in the story]. I have all sorts of hats and different props and they become the characters and then they move around and everyone else is cheering them on. I use a lot of music. I love field trips. One strategy that popped out at me with brain-based teaching was to change the location of the kids and so today we went to another part of the building to do an activity but a bigger piece of that are field trips. We use a jump rope to conjugate verbs... the action and then the rhythm of the action and the repetition of that activity help the brain works. I use the element of surprise. I try to get them to figure out why you're doing what you're doing and I consider myself quite random and so I do activities like that a lot...today we were kicking a ball around because that was going to demonstrate verb kickers, subordinate conjunction and so during the activities one of the kids said,

“And I’m sure you’re going to let us figure out later why we’re doing this aren’t you?” I use Oreos to demonstrate separable prefix verbs and so they call them Oreo verbs...you keep them guessing and going why? Active role playing with categories of verbs...let them try and figure out the categories, create sentences... after we have several different verbs...we draw pictures for different things...I have a game of beans that we play with you know especially first year junior high you don’t want to overwhelm them but you want them to hear the language as much as possible. The whole idea is just to have them have as much fun as possible...I have kids act out in charades, we make up songs...I have a conjugation ball where we toss the ball around and whichever pronoun you see you have to conjugate the verb with that pronoun. Using these activities is brain-based since they use whatever parts of the brain are the memory retention ones or get my attention ones. If it gets their attention and if it keeps their attention and if I hear them talking about it in the hallways, then I know that it’s been the right activity to do. (Teacher C)

Countering student apathy

When teachers were asked how these strategies affect student learning in their classrooms, the emotional state of the learner as s/he approaches a learning task was of primary concern. Question four raised the issue of student motivation and engagement and offered up four themes; countering apathy, fun versus fear, instilling the love of language learning and promoting success. Teachers spoke of applying strategies that engage the learner’s natural brain processing, to increase motivation and enjoyment. Specifically strategies such as providing novelty, chunking information into manageable bits, presenting “less is more”, patterning, repeating and reinforcing content, acquiring language developmentally, and offering meaningful context through exciting delivery were central to affect on learning. Teacher A discussed the association of emotions and motivation.

I share with my students how the brain learns and how their amygdala is responsible for the emotional state of their learning...I found that the biggest change [in learning] is a component of motivation and I am always looking at how these new strategies affect motivation because the biggest problem is apathy for French. Taking a look at memory and chunking, I’ve done a lot with trying to give concrete models to students about how to approach studying vocabulary and I’ve seen significant change. I spend a lot more time showing them how to learn

the vocabulary and how to chunk it into reasonable size, how to check to see if they are truly understanding it, before going on to the next manageable chunk. The strategies for repetition, reinforcement and novelty are very important. (Teacher A)

The manageability concept of information presented in bits was described as “overloading the table” by Teacher B. She also emphasized that repetition and reinforcement were critical in minimizing student frustration.

You are trying to make sure you address a limited system so that information can get through it all...you are trying to work with as many modalities as possible without overloading and so brain-based strategies are to teach in a way that doesn't overload the [students'] table of information.

I think that it [not enough repetition] was frustrating because I think there wasn't enough repetition and there wasn't enough reinforcement for them [students] to do what they want to be able to do...being able to talk. So that was frustrating. (Teacher B)

The use of TPRS, while demanding a lot of preparation, was an example provided by Teacher D who also described how chunking and repetition enhanced student comprehension.

It [TPRS] is a lot of prep and then it's a lot of the teacher in the front because how are they [students] going to learn unless they hear it over and over again. They're hearing me talking, a very authentic speaker, and I start telling the story just a little bit at a time and going around and asking questions about it. We're doing it together and I'm repeating over and over and I'm repeating the structures over and over while I'm getting more information from the students. They are in charge of me and it's not my fault if I go too fast and they didn't tell me. (Teacher D)

Teacher E presented natural language acquisition as “wrapped into a story”; a story that provided context and allowed for information to be acquired through connected bits of meaningful information.

I really think that TPRS does spark a lot for them [students], teaching in contexts with a limited pattern [for example] my colleague will decide to present zoo animals and teach forty zoo animals which first of all is too much of a pattern in my opinion and second of all there is no context. It's not wrapped into a story about going to the zoo and the lion eats the monkey, which is horrible, but you know what I mean, it's not, there is nothing to connect it to anything. So they teach it and there it is like a little glob and then when you move on to the next thing there is nothing to connect

it to anything and so it's gone. When you lack context, I just think it all falls apart. Repetitions, contexts, and actions together are the things that are brilliant about it. Natural language learning in general should be and is by definition a brain friendly activity. (Teacher E)

Fun versus fear/Love of language

Instilling the love of language and promoting success in students was tightly linked to presenting a new language through instructional activities that were non-threatening and fun. The fun versus fear factor was supported by several teachers as a motivator in their lesson design.

Teacher E went so far as to edit the school's foreign language curriculum by including "foster a love of language" as a main purpose. She also added that brain-friendly activities offer students an edge.

I'm actually just about to edit our curriculum guide and I'm going to put in our sixth grade program has two purposes and one is to teach kids, give them an approach to foreign language and how to learn a language because they do have to study it and they do have to listen and to foster a love of language. They'll love it and they will acquire it a lot better if we do brain-friendly. By using these activities I honestly think that it makes a big difference and you can see the light in their [students'] eyes and they like language and it's interesting to them. It's not boring. (Teacher E)

Love of learning and fun is central to Teacher's C class. Knowing that students talk about what they've done in her class substantiated and validated her approach and choice of instructional activities.

If the activity gets their attention and if it keeps their attention and if I hear them talking about it in the hallways, then I know that it's been the right activity to do... and that even relates into coming back into class the next day saying can we do that again? The kids love this class, when I see them happy to be in class, when they tell me this is one of their favorite classes, when the older kids come back to visit, all those connections tell me that the right things are going on. (Teacher C)

Positive engagement with what is being learned fosters fun and retention according to Teacher B. While fear, on the other hand, can make a learner more focused, the resulting narrow focus prohibits other learning to take hold. She also referred to being aware of the limbic system to avoid panic in the learner. Teacher G discussed fear in terms of a learner's comfort level with a new language this resulting in a hesitance to engage in activities and speak in front of others when uncomfortable.

I try to avoid panic at all costs by changing activities to accommodate different learners. I think that there can be a fear factor involved and that fear sometimes makes us more focused than we really should be so we end up with blinders on. My understanding is that if the limbic system responds negatively that nothing gets through to the rest of the brain. All your brain is doing is being in a panic and that everything is focused on being panicked and dealing with panic and you don't hear anything and nothing can get through into your long term memory. Reducing the level of panic is good. Overall more people are going to respond and be happy to be in class if they're not always in panic. (Teacher B)

Sometimes I think they [students] are intimidated and don't want to speak French... It's so much easier to use English, maybe they are afraid of how people perceive them. It has more to do with their skill level and what they feel comfortable with. (Teacher G)

Promoting success

In the brain-friendly classroom student success was perceived by several teachers not as a numerical grade or necessary proficiency level but rather as genuine love of language. Fun, comfort, and love were achievement descriptors. Teachers were asked how they perceived their students' success. They overwhelmingly stated that learning was measured in terms of student motivation, engagement in and passion for the language.

To me it's obvious what brain-based teaching and learning will do for your classroom. They like foreign language and they enjoy being there. (Teacher E)

I see kids who never were able to achieve in a more traditional way really achieving at a very high level in language now. They're experiencing more success. They love language class, I mean it's fun because it's so easy they're sitting and listening and contributing and just practicing new words and it's not the same 'drill and kill' that I used to do to them and they are allowed to create or write creatively and tell crazy stories and sing songs, and the experience is more pleasant for them now... and even the kids who still struggle, they're able to retain quite well. I feel like they are able to express so much more and that they enjoy it and they see language as something that's meaningful and purposeful for them. They feel like they can do it now and that's powerful. I'm trying to instill in them that language is exciting because it allows you to express yourself. That's what we love to do wherever we go is to communicate with people. (Teacher F)

I found that the biggest change in students is more of a component of motivation. (Teacher A)

I don't think that you lose any academic rigor by having fun and by encouraging you students to have fun. (Teacher B)

When I use storytelling the way it's suppose to be done, everyone in the class, the low kids can be successful, everybody can be successful, but when you teach the other way, you've got to have your As and you've got to have your Ds. I'm teaching them in a meaningful context. I'm not just giving them a list to memorize. They're learning the word in terms of a story and they're focused so much on the storyline they're not noticing that they're learning grammar and vocabulary as well. (Teacher D)

In their concluding remarks, the foreign language teachers interviewed formed a unified voice, demanding a need for more research to influence policy and guide foreign language teaching and learning. They expressed a desire for more workshops and professional training in how a person learns and specifically how one learns language. Several were pleased to know that what they were currently doing in the classroom is validated through research. And finally they all shared a common belief in the importance of individual uniqueness of each and every learner's capacity for learning. What is "best for kids" was at the heart of their teaching! How does the researcher describe this heart, this essence of their experience?

Essence of the Phenomenon

The brain is wired to explore his/her environment and seek out novelty and meaning (Sousa, 2006). Similarly the phenomenologist attempts to ferret out the true essence of the experience. This exploration required the researcher to analyze each transcript one by one. She read and re-read transcripts while noting comments in the margins and then color coding ideas and themes that emerged from the readings and creating lists of gerund forms for each theme. The resulting lists were then used as a set of points to return to the texts and interrogate them anew. The resultant structure and summary had as its purpose a clearer representation of what each participant was saying. The relationship between themes was then established. Additional structure was introduced into the analysis by clustering themes around each research question (Moustakas, 1994, Willig, 2001). Then in an extensive review of the material from various viewpoints and an examination of interrelationships between them, the essence of the participants' experience emerged from these clusters.

This inquiry foray required the researcher to move back and forth between the initial list of themes generated and the text from which the themes emerged in search of, as Creswell (1998) puts it "an overall description of the meaning and essence of the experience" (p. 150). This phase of data analysis required disciplined and devoted inquiry. Many hours of reviewing, rethinking and reflecting on words, phrases, and thoughts offered up pages of notes, color coded folders and countless 'post-it' notes that traveled from one folder to the next in an attempt to refine and deepen the researcher's knowledge of the phenomenon. Fittingly Moustakas (1990) equates a heuristic process of inquiry to psychological therapy. This investigatory pursuit takes the researcher

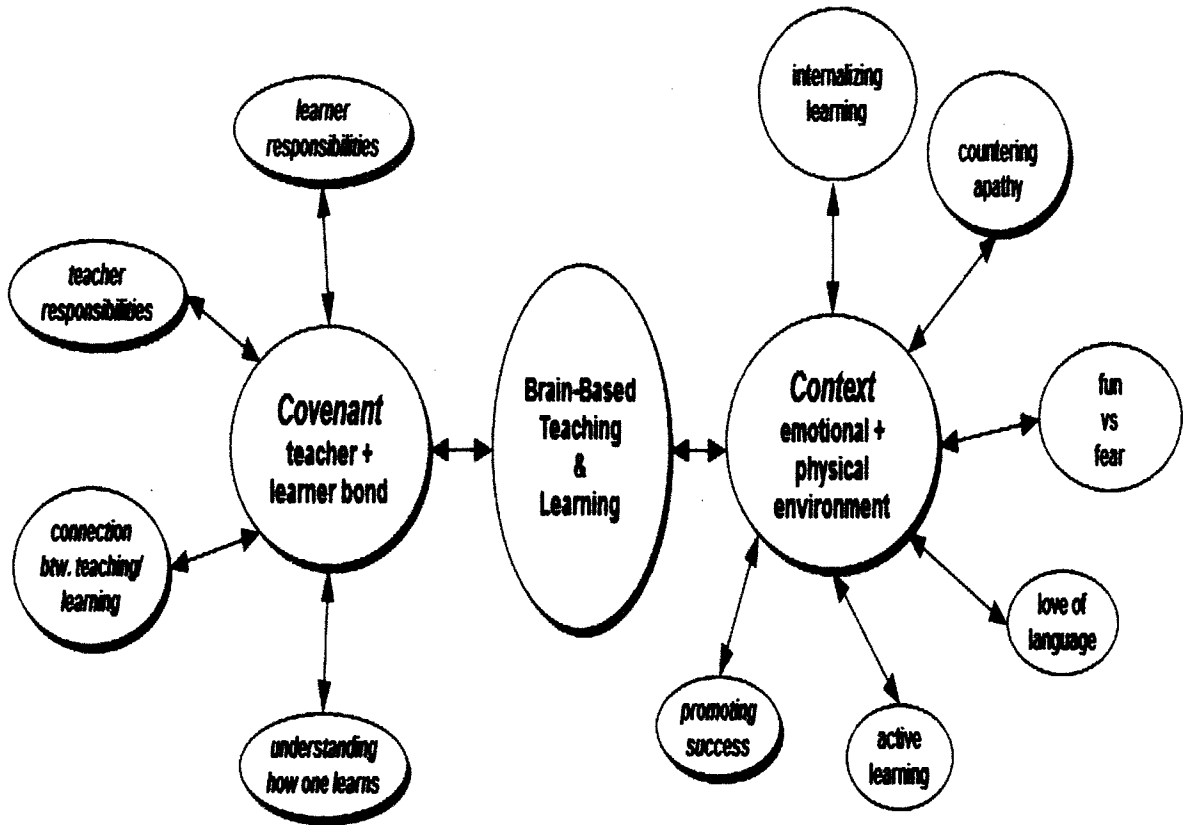
through “incubation to illumination to creative synthesis”. It is within this synthesis that an integration of cases or stories (as in this study) connects and blends, thus capturing the essence of the meaning of the shared experience. Willig clearly defines this process in the following.

This means that the group of participants is homogeneous to the extent that they share the experience of a particular condition, event or situation...which they are asked to describe to the researcher (Willig, 2001, p. 58).

In this phase of the analysis the “eureka moment” was realized. The essence of the phenomenon from the narratives emerged from the rich, thick data collected. The teachers’ narratives formed a collective voice. In an analysis of the interrelation between the ten themes that emerged from the four research questions and brain-based principles supported in the literature, two predominant arenas surfaced and fused the experiences of the participants. A generous blend of covenant and context bound their stories. The essence themes associated with the covenant and context are represented in Figure 3.

Figure 3

Covenant and Context Concepts



Summary of the essence

Much the way neural networks work together to form a memory network, as the amygdala and the hippocampus process in tandem what we learn and stores it in long term memory, a covenant and context synergy “describes how the joint actions of people working together increase each other’s effectiveness” (Sousa, 2006, p. 72).

Theses findings reflect the outcome of a phenomenological study of seven foreign language teachers. The study focused on their experience of brain-based teaching and learning. The essence of their experiences communicated itself as a bond between

teacher-student engagement (the covenant) and the setting of the life experience (the context) that is their connection. In this network in tandem between covenant and context the participants asserted that not only is student learning more successful but the value of their teaching is more meaningful.

In a value bound relationship (the covenant), teacher and learner form a system through which deeper learning occurs. The learning experience is secured in a common understanding of how a person learns and the role each plays in this endeavor. In support of this view, Gliner and Morgan (2000) use the terms “mutual simultaneous shaping [in which] everything influences everything else” (p. 21) to describe qualitative inquiry.

Learning is anchored within this shared system that advocates a quality environment with a variety of stimuli (the context). Instruction is paced in such a way that the learner can internalize, process and store new information. Heuristic (qualitative) research approaches discovery in much the same way as the learner that encounters chunks of information to process, absorb and imprint before moving onto to more. This paced delivery and internalization of knowledge are facilitated by the teacher, understood by the learner and accepted by both. Thus the learner’s framework of knowledge to which new information can be anchored is reinforced and strengthened.

While talking about their experiences, the teachers described contextual themes that I related to the nature and the quality of the experience. The nature of the experience (the covenant) expressed itself as part relational and part self-awareness. It was reflected in how teacher and student relate and interact with one another. The examination of this theme resulted in the identification of a covenant that joined teacher and learner in a collaborative effort that necessitated the engagement of both parties. This included an

understanding of the shared responsibilities in the learning process, that of the teacher and that of the learner. Self-awareness or meta-cognition expressed itself in a general knowledge of how we learn and then more specifically a deeper understanding of one's own learning style. Awareness of learning styles and multiple intelligences were integral to covenant as well.

The quality of the experience centered on the milieu or the context. Effective learning was addressed in terms of multiple contexts. These included salient characteristics of a brain-compatible classroom. The context included the emotional and physical environments. The relationship between emotion and cognition expressed itself in fun versus fear, love of language, and countering apathy. The internalization of learning, the rigor of activities, the relevancy and meaningfulness of the material and the promotion of success were also prevalent characteristics of the emotional and physical environment.

The essence of the phenomenon answers the primary research questions, "What are foreign language teachers' perception of brain-based teaching and learning?" A covenant context synergy emerged from the findings.

CHAPTER V

DISCUSSION

This final chapter is separated into four sections. The first section presents a brief summary of the study, revisits the purpose, design, methodology, and data analysis used. The section also presents a model as a visual representation that illustrates key findings and links these to current research and literature. Of particular importance, the essence themes and principles of brain-based teaching and learning are interrelated. The second section offers implications of the study based on the researcher's reflection on and interpretation of the findings. Recommendations for further research are made in the third section. I bring this chapter to a close with reflective comments in the conclusion.

Summary of the Study

The purpose of this qualitative study was to explore foreign language teachers' perceptions of brain-based teaching and learning. A phenomenological design was selected as the research paradigm. The researcher wanted to hear the voices of the participants as they described their experiences with brain-based teaching and learning and to better understand the meaning of their experiences.

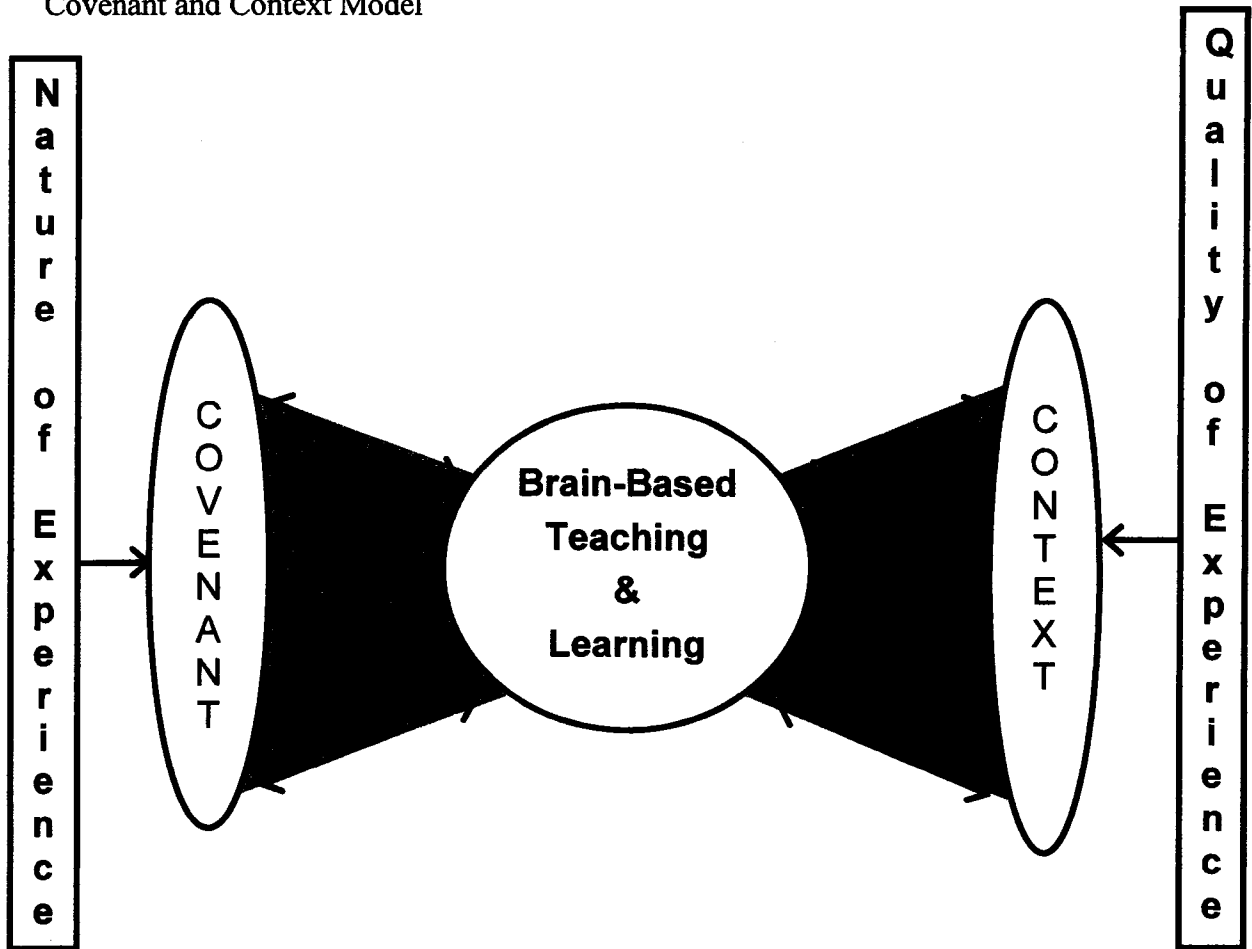
Seven foreign language teachers were selected to participate in the study. Criteria used to select the participants included direct recommendations from professors, participant referrals, and responses to solicitation from a foreign language teachers' professional list serve. Initially participant recruitment was via electronic mail through

the CCFLT list serve. Subsequent participants were contacted through referrals from Dr. Jean Radin and a snow balling procedure from selected participants. A letter explaining the research study was sent to each participant for clarification and review. Each participant also signed a consent form that was approved by the Colorado State University Human Subjects Research Committee. Face to face interviews were conducted at a time convenient for the participants and each interview was tape-recorded. The interviews were then transcribed by a professional transcriber.

A phenomenological inquiry was followed. This process included data collection, interpretation and narrative reporting. Structural guidelines identified by Moustakas (1994), Willig (2001) and Patton (1990) guided the study. The following components of inquiry were followed including, epoche, phenomenological reduction, horizontalizing individual statement, creating meaning units, clustering themes, and advancing textural and structural descriptions of the essence of the experience. Interview notes were analyzed for emerging themes and frequent responses. Data was interpreted and reduced into patterns, categories, and themes from which a larger picture emerged. Themes were identified within the participant's interview then across all participants' interviews. A final model (Figure 4) was created to interpret the findings and connect the themes that emerged from the study to current research in the field of brain-based research.

Figure 4

Covenant and Context Model



Covenant/Context Model

Brain-based teaching and learning forms the central core of this system. The nature of the learning experience is represented in the covenant as a synergistic relationship between teacher, learner and the learning. The covenant includes; roles, responsibilities, self-awareness, meta-cognition, interconnection of teaching and learning

and ultimately a rich understanding of the nature of learning from a biological standpoint.

These concepts are highlighted in the following quotes from two of the participants.

Taking the most recent knowledge about brain research and how the brain functions and then trying to apply that as best one can...to help students learn better. (Teacher A)

...students take advantage of their learning style so that they are efficient learners, so that they are using a set of review methods as part of a meta-cognitive process...training your brain. (Teacher B)

The quality of the learning experience, represented by the context, encompasses the physical and the emotional environment. The classroom setting, structure of lesson design, instructional strategies that help to internalize learning, engaging activities, relevancy to real world experiences, absence of threat and promotion of success are integral to the context. Emotion, excitement, motivation, attention, interesting, and light in their eyes is how these teachers describe the context.

I'm a teacher that believes in them [students] and a lot of the brain research is saying that you don't just learn through your brain, that you learn through all of our senses and our emotions...brain-based learning gives me this new tool to approach how I design my instruction [to be] exciting and that excitement then carries over [to the students] which helps in their motivation. (Teacher A)

Using these activities is brain-based since they use whatever parts of the brain are the memory retention ones or get my attention ones. If it gets their attention and if it keeps their attention and if I hear them talking about it in the hallways, then I know that it's been the right activity to do. (Teacher C)

By using these activities I honestly think that it makes a big difference and you can see the light in their [students'] eyes and they like language and it's interesting to them. It's not boring. (Teacher E)

The flexibility inherent in this model suggests a learning process that takes into consideration the plasticity of brain function as it acquires, processes and stores

information. Several key components in the covenant and context reflect the flexible transfer of knowledge and can be linked to current research in brain-based teaching and learning. Emotion, environment, motivation, memory retention, prior knowledge, and meta-cognition are active components of the model as well as salient aspects of learning with the “brain in mind”. Critical for the effective functioning of this model is a networking in tandem; a flexibility that permits the interaction among and within the components of the covenant and the context.

The interconnectedness between emotion and cognition is critical in the process of retention (Howard, 2000; King, 1997; Kotulak, 1997; Sousa, 2006). Memory is dependent on the workings and control of the limbic system and cerebral cortex. Emotions can trigger either a positive or negative response. A relaxed stress-free environment can help release endorphins into the blood stream. These trigger a feeling of comfort which in turns stimulates the frontal lobes of the brain and facilitates learning.

On the other hand, cortisol may be released due to heightened anxiety and/or fear. This chemical in turn shuts down the learning process in the neo-cortex while the brain concerns itself with the fear or stress at hand. A pronounced negative effect on how the brain processes information is witnessed in this “fight or flight” scenario (Sousa, 2006). King (1997) further highlights the connection between effective learning and stress and threat. He argues that increased cognitive processing occurs when the neo-cortex is permitted to function normally and stress and threat impede this process.

In addition to threat-free environments, Caine and Caine (1991), Diamond and Hopson (1998), Sousa (2006), and Jensen (2004) maintain that context-rich, meaningful, and authentic, materials stimulate the brain which promotes effective learning. The

active process of experiencing an authentic event for example activates the plasticity and parallel processing in the brain and strengthens neuronal connections. According to Sousa (2006) and others, when neuronal growth is strengthened the signals transmitted along an axon and across a synapse to the dendrites, the speed of transmission is increased. The myelin sheath which protects the axon is thickened and allows for a smoother, quicker transfer of impulses (Sousa, p. 21). Research in enriched environments (Diamond & Hopson, 1998) has contributed evidence that the weight and thickness of the cerebral cortex in rats is altered when provided with an environment which included stimulating activities and social interaction.

The model also reflects on the significance of prior knowledge and its effect on new learning and resulting affect on how a learner responds to teaching. Central to Zull's study in *The Art of the Changing Brain* (2002) and Bransford, et al. in *How People Learn* (2002) is finding out about what students already know. Strengthening existing pathways in the brain eases the retention process of new information. Zull refers to prior knowledge as "the beginning of new knowledge" (p. 93). New learning becomes relevant and meaningful. Students are apt to be more comfortable, confident and motivated to learn when they can connect the new to an established network or schema.

Finally, the relevance of meta-cognition is presented in the model as part of the covenant between teacher and student in understanding learning. Being attentive to how one learns is central to both the covenant context model and brain-based learning principles. Caine and Caine claim that to gain new insight one must be actively involved. A deeper understanding of brain uniqueness and how one learns are interactive elements essential to this involvement. The tenets of student-centered learning are anchored in a

belief that “the search for meaning takes a different route for each student” (Brooks, 1999). Here we see strong conviction in student self-efficacy in which a learner shapes his/her learning by gaining “executive control” over learning strategies (Joyce et al., 2004).

Study Implications

The intent of this study was to give voice to foreign language teachers, to listen and learn from their experiences and to create a body of knowledge that could serve others in our profession in their pursuit of best practices. This study benefits not only teachers but speaks to purposeful and informed practice in the future development and implementation of curriculum and professional development programs. Additionally, this model promotes a classroom culture that encourages and facilitates the creation and implementation of successful learning activities.

Effective instruction and learning, as described by the teachers in this study and embodied in a covenant/context system, enhances the general knowledge base of educational research. It would be remiss on our part to overlook the relevance of these findings in supporting effective teaching and learning. Indeed if we are committed to leaving no child behind then brain-based research should become integral in the pursuit of educational excellence.

Policy makers at the national and state levels can draw on current research to guide future decisions on redefining educational standards. Teaching methodology courses at the college level can incorporate current findings on mind/brain research into class syllabi to offer teacher education students empirical data from which to create their

own teaching philosophies. At the community level, in-service professional development training, for example, can benefit from workshops on the biology of learning that connect research to classroom practice. Further implications can include curriculum design and lesson plan structure that consider the natural learning process as a critical component of effective learning. The findings in this study add to a cumulative knowledge of teaching and learning in general as well as diversify and strengthen current methods of second language acquisition.

The experiences of the teachers in this study provide a necessary spring board for future discussion and reflection on the implications of creating brain-friendly classrooms. Teachers were eager to share their experiences and contribute to research in the field of foreign language. Additionally, discovering that their classroom experiences were supported by current studies also helped confirm their teaching methods. I heard over and over again how current research in brain-based strategies validated what many of these teachers were already doing naturally in their classrooms and seeing in their students. Doing what's right for kids guided their instruction. The participants' overwhelmingly positive response to the implementation of these practices in their classrooms begs for further investigation.

The passion with which the teachers shared their many activities inspired and motivated me to learn more as well. I find myself reading every article with "brain or mind" in it. It has become a part of a personal life long learning process.

In consideration of the number of participants in this study, including only seven teachers, the passion witnessed in these teachers is certainly a sign of less is more and this more matters. I feel that the findings are in no way diminished by the size of the

study. The findings in this study enhance current knowledge and they also beg the question whether neuroscience research should guide instruction?

Recommendations for Future Research

The purpose of this study was to examine foreign teachers' perceptions of brain-based teaching and learning and describe what they found significant. Based on the findings, I suggest the following recommendations for future research in the realm of cognitive/neuroscience research and classroom practice:

1. More research is needed to evaluate the effect of brain-based teaching and learning strategies on foreign language proficiency levels.
2. Additional educational research is needed to examine in greater depth the implications of neuroscience research on how the brain learns and how teachers teach regardless of subject matter content.
3. A mixed-method longitudinal research study is recommended to interview, observe and track students in brain-friendly classrooms to determine the affect on second language acquisition.
4. This study focused on second language acquisition (L2) only. A similar study could be conducted on ESL teachers to discern similar/dissimilar findings and learn their perceptions of brain-based instruction in their classrooms.
5. An extension of this study would be to relate perceptions and themes found in this study to what is actually happening in the classroom through observations and interviews with students.

6. Another extension of this study would be to interview students whose teachers use brain-based teaching and learning in their classrooms to listen to their stories and gain insight into their experiences.
7. A logical extension of the above is to interview parents of students whose teachers use brain-based strategies and activities in their classroom to examine their experiences.
8. This study focused on foreign language teachers in a k-12 educational setting. Additional research could broaden this study's focus by including instructors in higher education to ascertain their perceptions and the themes evident in their experiences with brain-based teaching and learning.
9. With the implementation of national standards for foreign language learning, further research is needed to examine the connection between the standards' five main goals (communication, cultures, communities, connections, and comparisons) and brain-based teaching and learning.
10. Additional venues for continued general research in the field of experiential education are warranted.

Conclusion

The guiding focus of this study was teachers' experiences with student learning and language proficiency in a brain-friendly environment. The participants in this study discussed teacher student roles and responsibilities and presented best practices and effective strategies used in their classrooms. The student/teacher relationship and the structure and setting of learning were found to be critical. The role of teacher as facilitator of knowledge and student as participant in this learning engagement is at the heart of student centered learning and constructivist theory. Given the appropriate tools, guidance and environment, the learner not only creates his/her own learning but better comprehends the relationship between cognition and emotion. Likewise, the facilitator recognizes the value of engaging students through activities that spark curiosity, offer novelty and choice, reinforce prior knowledge, instill creativity, challenge senses, affect motivation, pace and chunk content, enhance memory retention, and ultimately teach students how they learn best. The successful mastery of a second language requires that teachers draw on a multiplicity of approaches, methodologies and strategies that reach out to a diverse population of learners. In classroom application of varied methods, activities, and strategies by the teachers in this study strongly reflected many tenets of brain-based teaching and learning supported in the literature.

According to the teachers, presenting language in this way proved effective however administrative acceptance of these methods was not always widespread. Several teachers expressed frustration with an inflexible system that still adheres to traditional procedures and practices. They spoke of "being constrained by the curriculum and text"

and burdened by “just getting through the chapters”. Several complained of administrators that were “not up to date on best teaching practices [unaware of] natural learning as opposed to grammar drills and simply ramming learning down their [students’] throats”. Yet, I found ardent determination in these teachers to uphold their belief in creating a brain-friendly classroom despite pressures from administration. They see what works for their students and therefore strived to ensure that quality instruction and effective learning happen in their classrooms.

Although controversy exists as to the acceptance and applicability of neuroscience in the context of education, I discovered that brain-based teaching and learning principles can offer pedagogy, the science of teaching, an opportunity to better understand and act on the biological aspect of learning. I do not offer this instruction as a panacea or cure for all, however brain-compatible principles applied to instruction can be an essential catalyst or conduit to ease the path for effective change in the classroom. As we acquire more knowledge and move towards a better place of best practices and effective strategies, we can suggest new tools that speak to our changing students’ needs.

To find this better place, we ought to increase awareness and visibility of new research in the field of teaching and learning. Teacher training and professional development programs can include sessions that address current neuroscience research. Experts in the field of brain-based teaching and learning can be invited to in-service informational seminars at local schools to introduce and offer their expertise in bridging research to classroom practice. Additionally district-wide task forces could be formed to investigate new/innovative instructional methods and then present their findings to local schools. Individuals with direct interest, involvement, and investment in student learning

should form the body of this force. Connecting the expertise of researchers and the hands-on knowledge of practitioners is vital to this process. Administrators as well as classroom teachers and interested parents should be included in these committees to ensure that the voices of constituents are heard and knowledge shared. The potential outcomes of these informational meetings could translate into the adoption of more flexible and diverse approaches in how to effectively present curriculum.

Ultimately, this manner of academic advertising can help present and promote new findings in the field of educational practice. What we are really doing is getting people to think. People are consumers of knowledge whose brains are constantly processing information. The more they hear, see, and experience the more they internalize and the greater the likelihood that they will rethink, remember and reflect on this information. Reflection may in turn influence decision making and policy implementation.

I would like to conclude this chapter with a quote from Howard Gardner taken from a paper he presented at the American Educational Research Association in Chicago in April 2003. In his closing remarks, Gardner reflects on over twenty years of work in the field of intelligence theory. Given the new biological knowledge of how people learn, Gardner expresses his wishes for at least another lifetime in which to “rethink” the nature of intelligence. Yet he is content to pass the gauntlet on and let others play.

But I am glad to have had the chance to make an opening move some twenty years ago; to have been able to revisit the game board periodically; and to lay out this problematic so that other interested players can have their chance to engage. (Gardner, 2003, p. 14)

We have only begun to fathom the intricate workings of the mind/brain and its relation to language learning. But I believe we are nearer to accepting that learning in general has taken on a new persona. And s/he is part magical neural forests. Further studies in the field of neuro-cognition will lead us closer to a better understanding of this place we call learning. I am grateful for having had this opportunity to make a small move in ongoing research and contribute to brain-based teaching and learning and second language acquisition awareness. We must all be interested players and take the chance to engage. This matters.

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APPENDIX A

Informed Consent

Informed Consent to Participate in a Research Study
Colorado State University

TITLE OF STUDY: Brain Compatible Teaching and Learning in the Foreign Language Classroom: Teachers' Voices.

PRINCIPAL INVESTIGATOR: Jean Lehmann, Ph.D. Interim Director School of Education. (970) 491- 6317, lehmann@cahs.colostate.edu.

CO-PRINCIPAL INVESTIGATOR: Melitta Wagner-Heaston, Doctoral Candidate, School of Education. (303) 404-2326, melittawh@mail.com

PURPOSE OF THE RESEARCH:

The purpose of this study is to discover the experiences of foreign language teachers with regard to brain compatible teaching and learning principles. A qualitative interview research method will be used resulting in a description of themes and patterns of the experience. The study will be conducted in the state of Colorado and include K-12 foreign language teachers.

PROCEDURES TO BE USED:

The primary method of data collection is through participant interviews. After you have agreed to participate in this study, the researcher will email you the Informed Consent form to read and sign. By signing the consent you have volunteered to participate in a personal interview that will be conducted at a mutually agreed upon location and time. The researcher will conduct a 50 – 60 minute interview. The interview session will only consist of the interviewee and the interviewer. Interviews will be audio taped and later professionally transcribed. The narrative data from the interviews will be analyzed for understanding and the development of themes and patterns. These themes and patterns will be discussed with you by telephone or email to assure that your experience is accurately described. A follow up meeting and/or class visit may occur to clarify details from the interviews and to observe your experience in the classroom. Upon completion of these procedures, all interviewee participants will receive a comprehensive analysis.

RISKS INHERENT IN THE PROCEDURES:

There are no known risks. It is not possible to identify all potential risk in an experimental procedure, but the researcher has taken reasonable safeguards to minimize any known and potential, but unknown, risks.

Page 1 of 3 Participant's initials _____ Date _____

BENEFITS:

There is no known benefit in participating in this study. However, we hope that this study will provide you with additional information on brain compatible teaching and learning for your classroom instruction.

CONFIDENTIALITY:

The identity of all research participants will remain confidential. The names of the interviewee participants will only be known to the Investigator and Co-Investigator. Your information will be combined with information from other people taking part in the study. When we write about the study to share it with other researchers, we will write about the combined information we have gathered. You will not be identified in these written materials. We may publish the results of this study; however, we will keep you name and other identifying information private. All materials, including audio tapes, letters, emails, and field notes will be kept with the PI, Jean Lehmann, in confidential files in a locked facility for three years. The audio tapes will be destroyed upon completion of the dissertation. After three years, all other materials will be destroyed.

LIABILITY:

The Colorado Governmental Immunity Act determines and may limit Colorado State University's legal responsibility if any injury happens because of this study. Claims against the University must be filed within 180 days of the injury.

QUESTIONS/CONCERNS:

Before you decide whether to accept this invitation to take part in the study, please ask any questions that might come to mind now. Later, if you have questions about the study, you can contact the investigator, Melitta Wagner-Heaston at 303-404-2326. If you have any questions about your rights as a volunteer in this research, contact Janell Meldrem, Human Research Administrator at 970-491-1655. We will give you a copy of this consent form to take with you.

PARTICIPATION:

Your participation in this research study is voluntary. If you decide to participate, you may withdraw your consent and stop participation at any time without penalty. Participation includes the willingness to be interviewed. Participants can be removed from the study if they do not participate in the interview without penalty. Your signature acknowledges that you have read the information stated and willingly sign this consent form. Your signature also acknowledges that you have received on the date signed, a copy of this document containing 2 pages.

Page 2 of 3 Participant's initials _____ Date _____

Signature of person agreeing to take part in the study

Date

Printed name of person agreeing to take part in the study

Name of person providing information to participant

Date

Signature of Research Staff

Page 3 of 3 Participant's initials _____ Date _____

APPENDIX B

**Letter to Colorado Congress of Foreign Language Teachers
(CCFLT list serve)**

Recruitment Materials: CCFLT list serve email.

TO: Colorado Congress of Foreign Language Teachers
From: Melitta Wagner-Heaston, Ph.D. Candidate, Colorado State University, Fort Collins, CO

Colleagues:

My name is Melitta Wagner-Heaston and I am a doctoral candidate at Colorado State University in the Educational Leadership program. I am currently working on my dissertation and am recruiting participants from the CCFLT.

My research focuses on brain-based teaching and learning in the foreign language classroom. The research approach is a qualitative design in which I would like to describe your experiences as foreign language teachers. The study requires interviews of no more than one hour with teachers who are familiar with brain-based principles also known as brain-friendly and brain-compatible.

I am inviting interested teachers of any foreign language, at any level of instruction who use these principles/techniques in their classrooms to participate in my research. Be advised that all data will remain anonymous and there is no known risk to participants. Please contact me by replying to me via email at: melittawh@mail.com for any additional information and/or to participate in this study.

I look forward to hearing from you.

Melitta Wagner-Heaston
Ph.D. Candidate
School of Education
Colorado State University
Fort Collins, Colorado

Office: 970 351 1753 Home: 303 404 2326
Email: melittawh@mail.com
melitta.wagnerheaston@unco.edu

APPENDIX C

Application for Human Subjects Research Review

Office Use Only: HRC Tracking number: _____	
Type of Review: <input type="checkbox"/> Exempt <input type="checkbox"/> Expedite <input type="checkbox"/> Full	Category # _____ PI Trained Y <input type="checkbox"/> N <input type="checkbox"/>

**APPLICATION FOR HUMAN SUBJECTS RESEARCH REVIEW
 COLORADO STATE UNIVERSITY
 (Please type or electronically fill)**

Complete the cover page, review summary, and sections A, B, C & D. For full review protocols, submit the ORIGINAL (with original signatures and copy of proposal/dissertation/thesis) and 13 copies (each with attachments except proposal/dissertation/thesis) to Regulatory Compliance Office (RCO), 321 General Services Building, Campus Delivery 2011. Assistance is available on the RCO web site at <http://www.research.colostate.edu/rcoweb>

H-100 COVER SHEET Part A
Project Title (identical to proposal or thesis/dissertation): Brain-Compatible Teaching and Learning in the Foreign Language Classroom: Teachers' Voices.
OR Grant Title if different from Project Title:

Contact Information

Principal Investigator (PI):

Name: Dr. Jean Lehmann	Department: School of Education
Campus Mailing Address & Mail Code: 109 Education Bldg	Phone #: 970 491 6317
E-Mail Address: lehmann@cahs.colostate.edu	

Co-Investigator (attach information if more than one Co-PI):

Name: Melitta Wagner-Heaston	Department: School of Education
Campus Mailing Address & Mail Code: home address: 14128 Blue River Trail Broomfield, Co 80020	Phone #: 303 404 2326
E-Mail Address: melittawh@mail.com	

Funding Source: n/a	PASS #:
Proposed Start Date (may not precede approval date): OR <input checked="" type="checkbox"/> "Upon HRC approval"	If Co-PI is a student, is this project for a: <input type="checkbox"/> thesis <input checked="" type="checkbox"/> dissertation <input type="checkbox"/> other
I think this qualifies for the following type of review: <input type="checkbox"/> Exempt Category number _____ (submit original) <input checked="" type="checkbox"/> Expedite Category number 7 (submit original & one copy) <input type="checkbox"/> Full Review (submit original & 13 copies)	New Protocol YES <input checked="" type="checkbox"/> NO <input type="checkbox"/> Resubmission YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> Follow-up to 118 request YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>

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: _____ Date: _____

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

Department Chair/Head or Acting Signature

Signature: _____ Date: _____
 (If PI is Department Head, please have alternate/designee sign)

PART B. RESEARCH PROJECT REVIEW SUMMARY Your completion of the following checklist will facilitate the review process.

1. **SUBJECT POPULATION:** (Check all appropriate boxes.)

- | | |
|--|--|
| <input checked="" type="checkbox"/> Healthy adults | <input type="checkbox"/> Children or minors (<18) |
| <input type="checkbox"/> Institutional residents | <input type="checkbox"/> Cognitively or psychologically impaired |
| <input type="checkbox"/> Elderly | <input type="checkbox"/> Pregnant women or fetuses |
| <input type="checkbox"/> Prisoners or parolees | <input type="checkbox"/> Non-English speaking |

2. **IF THE RESEARCH INVOLVES ANY OF THE FOLLOWING, CHECK THE APPROPRIATE BOXES:**

- | | |
|--|--|
| <input checked="" type="checkbox"/> Interview | <input type="checkbox"/> Survey/questionnaire |
| <input type="checkbox"/> Clinical studies | <input checked="" type="checkbox"/> Behavioral observation |
| <input type="checkbox"/> Investigational drugs | <input type="checkbox"/> Investigational devices |
| <input type="checkbox"/> Deception | <input type="checkbox"/> Waiver of consent |
| <input type="checkbox"/> Study of existing data | <input type="checkbox"/> Controlled substances |
| <input type="checkbox"/> Study of human biological specimens | <input type="checkbox"/> Microorganisms or recombinant DNA |
| <input type="checkbox"/> Venipuncture | <input type="checkbox"/> Genetic research |
| <input type="checkbox"/> PI or Co-PI is the treating physician | |

3. **LOCATION(S) OF RESEARCH TO BE CONDUCTED AT:**

- | | |
|-------------------------------------|---|
| <input type="checkbox"/> CSU campus | <input checked="" type="checkbox"/> Other locations, specify: K-12 Colorado Schools |
|-------------------------------------|---|

4. **INFORMED CONSENT OF SUBJECTS:** Your study protocol must clearly address one of the following areas: (justification for #2 & #3 must be included in your application) Discuss details in purpose section, (question If).

- INFORMED CONSENT:** Signed informed consent is the default. A model consent is available on the HRC website and should be used as a basis for developing your informed consent document. **If applicable, the proposed consent must be submitted with the study protocol.**
http://www.research.colostate.edu/rcoweb/hr/hr_forms.htm

- COVER LETTER:** You may request a waiver of documented informed consent under the following conditions: (1) *That the only recording linking the subject and the research would be the consent document and the principle risk would be potential harm resulting from a breach of confidentiality. Each subject will be asked whether the subject wants documentation linking the subject with the research, and the subject's wishes will govern; (45CFR46.117c1), OR* (2) *That the research presents no more than minimal risk of harm to subjects and involves no procedures for which written consent is normally required outside of the research context. (45CFR46.117c2).*

It is the responsibility of the investigator to: a) provide clear justification for how a project meets the criteria for waiver of documented informed consent under one of the two previous categories, and b) provide what will be used to inform the subjects about research activities. It may be a telephone or verbal script, a cover letter, or some other means.

The cover letter needs to be sent to the subjects and to the HRC on CSU departmental letterhead.

- NO INFORMED CONSENT:** You may request a waiver of informed consent under the following conditions: (1) *The research involves no more than minimal risk to the subjects; (2) the waiver or alteration will not adversely affect the rights and welfare of the subjects; (3) the research could not practicably be carried out without the waiver or alteration; and (4) when appropriate, the subjects will be provided with additional pertinent information after participation (45CFR46.116d).*

It is the responsibility of the investigator to: a) explain how a project meets all four of the criteria for waiver of informed consent and b) where applicable, provide an alternate form of sharing study information with prospective subjects (i.e., a public service announcement, or a modified version of a consent to be used in research that by design requires deception – this type of research requires an accompanying debriefing form that completes the informed consent process).

PART C. RESEARCH PROTOCOL:

I. PURPOSE, METHODS, AND PROCEDURES: Describe the following:

- a. Purpose (will be used in assessing the risk/benefit ratio for subjects. The hypothesis to be tested may be listed.) **The purpose of this study will be to acquire an understanding, examine, and describe second language teachers' experiences with brain-compatible teaching and learning. Interviews will be conducted with Foreign Language Teachers. Follow up classroom observations may occur to acquire knowledge of teacher practices and experiences in a natural setting.**
- b. Research methods and procedures of the study. (It is OK to diagram complex designs. Please include information on the time commitment required for each activity.) **One on one interviews with informants.**
- c. Variables to be studied (what is being measured or examined). **Experiences with Brain-Based teaching and learning of Foreign Language teachers.**
- d. Describe equipment used with subjects, if any. **A tape recorder will be used for the interviews.**
- e. How will subject confidentiality or anonymity be maintained? If a linked list is used, list when it will be destroyed. Provide a sample of the code that will be used. **Researcher will refer to informant as Teacher 1, Teacher 2, etc...No names of teachers or schools will be used.**
- f. Describe the consent process and method of consent to be used. (*signed consent, cover letter, other*) **A signed consent from the teacher participants will be used to inform and explain confidentiality of interviews and procedures.**
- g. How will research records be maintained during and upon completion of the project? (This may include audio or videotapes). Indicate when the records and/or tapes will be destroyed. **Federal Regulations require that study data and consent documents be kept for a minimum of 3 years after the completion of the study by the PI; for longitudinal projects, a longer period may be needed.**
Audio tapes will be used during the interview process. Note taking will occur during the observational portion of the research. No videos will be used either during the interviews nor during classroom observations to protect individual anonymity.
- h. Address how you will monitor this study to ensure that the study is being conducted according to the protocol. **In the cover letter, the researcher will define the protocol so that informants are aware of confidentiality and absence of risk.**
- i. Is a Data Safety Monitoring Board required to conduct such monitoring? YES NO
If yes, the HRC may request copies of the reports.

II. SUBJECT SELECTION: Indicate the following (this section must also be completed for secondary data analysis):

- a. How will subjects be recruited and where will the recruitment take place? (submit recruitment material) **Recruitment will take place through professor recommendations and solicitation on the Colorado Congress Foreign Language Teachers' list serve.**
- b. If secondary data analysis is being conducted, please describe the original consent procedures. *n/a*
- c. What are the characteristics of the subject population? (age, gender, student, disease conditions, behavioral abnormalities; affiliations or memberships) **Healthy Adults**
- d. How many subjects do you plan to study? **up to 20 or until saturation**
- e. Address the inclusion and exclusion criteria. Federal regulations consider minors, pregnant women and prisoners vulnerable populations that require added protection. When vulnerable populations are involved, describe why they are necessary. Excluding any group, i.e., minors, elderly, gender, ethnic minorities, must be clearly justified and inconvenience can't be the reason. **For example, if minors are in a classroom where recruitment will take place, parental permission must be obtained or justification must be made to exclude the minors. Recruitment will not take place in a classroom setting.**
- f. Will subjects be compensated for participation? If so, please describe the proposed compensation. *n/a*
- g. Criteria for excluding participants involuntarily (such as "failed to keep food diary as required") **Teachers unfamiliar with Brain-Based principles of teaching and learning will be excluded from this study.**
- h. Letters of agreement/approval from the organizations that will be recruiting subjects for the project will be needed. Such letters need to be initiated by the organization, on organization letterhead, and signed by a person authorized to do so. The letters need to include statements a) that the organization is familiar with the scope of the project, b) that it is satisfied the individuals it is involving are adequately protected as human research subjects, c) that the subjects' participation is completely voluntary, and d) identify what the organization's involvement will entail.

III. RISKS AND DISCOMFORTS:

- a. Describe any potential risks to subjects and assess the likelihood and seriousness of those risks. (If there are no known risks, state as such, but do NOT respond "NA".) These could include: physical, psychological trauma or stress, legal, social, economic, loss of confidentiality. **No known risks.**

- b. Please describe the proposed methods to minimize the risks and discomforts associated with the research. For example, document how potential psychological distress will be addressed, by whom, and with what credentials (provide letter of agreement from counselor explaining their role – this must be someone other than the researchers on the project) Specify what factors will lead to stopping procedures causing physical or emotional stress. **Interviews will be conducted in a mutually agreed upon location. Measures to minimize participant discomfort will be addressed and discussed. Informal setting will be appropriate and create a relaxed atmosphere for discussion.**
- c. If the methods of research create potential risks, describe other methods, if any, that were considered and why they will not be used. **no known risks.**
- d. Address procedures for maintaining confidentiality if a breach of confidentiality represents a risk. **Researcher will address any risk associated with a breach of confidentiality with the informants prior to any interviews. It is the researcher's intent to inform potential participants of any questions concerning confidentiality prior to commencing the interview process. If a participant is uncomfortable with the interview process for any reason, he/she may voluntarily remove him/herself from the research.**

IV. ADVERSE EVENTS: Explain your reporting mechanism for reporting adverse and serious adverse events to the HRC. Through direct communication with HRC personnel via phone and/or email.

V. BENEFITS: Describe the anticipated benefits of the research to the individual subjects, to the particular group or class from which the subject population is drawn. The benefits must be realistic and not overly stated of what each person is likely to gain from the research. If there is no direct benefit to the subject, state so. For example: "There is no known benefit in participating in this study, but we hope you will gain more knowledge on..." Compensation, payment for participation, gifts, etc., are NOT benefits. **There is no known direct benefit in participating in this study, however the knowledge gained through this research may be valuable to the discipline of Foreign Language education in general.**

VI. Other matters pertinent to the human participant. none known

Part D. SPECIAL REQUIREMENTS/ATTACHMENTS CHECKLIST: For the items below, check where applicable and include with your protocol submission. Items marked "required" must accompany an HRC protocol application or the project can not be approved.

Research Proposal Materials

- Grant proposal** (if this is a funded project, this is required)
- Thesis/dissertation methods** (if the project is a thesis or dissertation, this is required)
- CV** (If this is a first time submission as PI, this is required. A current copy of the curriculum vitae of the PI must be on file in the Administrator's office. If the PI has submitted a vitae since July 1 of the current year, the PI does not need to include it with this application).

Research Instruments/Tools

- Informed Consent**, or
- Cover letter** (with justification for waiver), or
- Justification for waiving informed consent**
- Interviews** (phone or in person) - attach script if applicable and questions to be asked.
- Surveys/questionnaires** - attach surveys and questionnaires if applicable. Provide permission use for instruments (whether copyrighted or public domain)
- Focus Groups: attach introductory script to the group and sample questions. (describe in consent form what a focus group is)**
- Recruitment materials:** Advertisements, press releases, in-class announcements, posted flyers, e-mail announcements, phone script, or other forms of recruitment.
- Debriefing Materials**

Research Collaboration/Support Materials

- IRB approval** from other institutions involved in research (collaborating university, hospital, etc.)
- Letters of cooperation** from participating sites that do not have an IRB.
- Letters of agreement** (i.e., from a site that is allowing you access, but is not directly involved in research, or a colleague allowing you to recruit from a class, a clinic or business allowing recruitment, etc.)
- Letter of collaboration** from a counselor if needed.

Secondary Data Analysis (for research involving secondary data analysis, include original IRB approval and informed consent)

- IRB approval from collaborating organization
- Consent form from original data analysis