Making Brain Research Matter:

A Multidisciplinary Approach to Second Language Acquisition Research

A Review of the Literature

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Rationale

The purpose of this paper is to establish a contextualized framework for building a literature review for my dissertation. This is a rather daunting task since I have yet to define my dissertation topic. Nevertheless, I feel the need to reflect upon my journey through the doctoral program thus far in order to synthesize what I have learned from the courses I have taken and the professional experiences I have had. I realize that this early design for my literature review will include sections that may not be complete. The goal then, is to establish a framework that will allow me to augment sections as I progress through the program.

Unsure where or how to begin, I asked myself the following question: How have various course readings, projects, and professional experiences changed my ways of thinking about my role as a researcher and a scholar in the field of world language education? My initial goal for pursuing a doctorate degree was to learn how to conduct meaningful research so that I might be able to contribute to the field of world language education. After a year in the program, my goal has not changed. Interestingly, what has been undergoing a metamorphosis is my definition of "meaningful research." To fully explain this change in my thinking, I will use this paper to illustrate the interrelationship of concepts such as cognition, intelligence, and brain-based teaching with respect to how we now define learner diversity. And, I will use this new definition, this new perspective of diverse learner needs to draw upon socio-cultural theory and the recent views of critical pedagogy to address questions such as: who should benefit from my research?

It is the process of redefining my understanding of "meaningful research" that I hope to establish the contextual framework of my literature review. Then, as I sort through the scholarly writings in the field of second language acquisition research, I hope to identify a gap from which I might focus my dissertation.

Introduction

> *As soon as one treats language as an autonomous object, accepting the radical separation which Saussure made between internal and external linguistics, between the science of language and the science of the social uses of language, one is condemned to looking within words for the power of words, that is, looking for it where it is not to be found. (Bourdieu, 1991a, p. 107)*

Language Learning and the Power of Words

The quote by Bourdieu serves as a point of departure as it leaves the reader questioning how one should treat language learning in order to best understand the power of words. For Bourdieu, the power of words is symbolic. It reflects the complexity of the relationship between the individual and the social uses of language. Within that relationship are the values, beliefs and attitudes associated with social identity. The exploration of the relationship between language and culture can be found in the work of Joan Kelly Hall. Hall (2002) notes that the power of language and the meaning we derive from words is dependent upon various social memberships and the histories of their evolution. To understand how social memberships evolve, Hall (2002) says that an individual's social identity develops through a process in which the world and the people within it are sorted into groups that are then made meaningful by "larger social forces." These social forces often include the values that are placed on the languages that are spoken within groups and subgroups. Rarely are these values equal. The result is that one language emerges as having a higher value, a higher social status and thus, a higher symbolic power (Bourdieu, 1991b; Hall, 2002). Those who speak that language may share the same social status, and thus similar social identities (Bourdieu 1991b; Hall, 2002). If we cannot separate language

from social identity, then we will have to, at the very least, acknowledge this relationship as we study how languages are learned.

The idea for studying language learning through an interdisciplinary lens is not new. The argument for a more holistic approach to second language acquisition (SLA) research has been made, perhaps most notably, by Firth and Wagner (1997). Similar to the separation between internal and external linguistics that Bourdieu (1991a) referred to, Firth and Wagner (1997) describe the dichotomy among SLA theorists as the division between those who support language learning as a social phenomenon and those who believe that language learning is an individual process of mastering a symbolic system. As in many societies, a dominant group has emerged from within the culture of SLA research. For the better part of the 20th century, an inequitable distribution of power has been produced and reproduced by individual members of the SLA culture who support the idea that language learning is predominantly a process of internal linguistics. Thus, the majority of SLA research focused on studies that view language learning as an individual process of acquiring grammatical competencies (Firth & Wagner, 1997).

The problem, as noted by Firth and Wagner (1997) is that this imbalance of theoretical research has lead to pedagogical models that focus more on the mastery of grammar and less on communicative abilities. They further believe that research skewed toward internal linguistics and cognitive science has "distorted descriptions of and views on discourse, communication, and interpersonal meaning (Firth & Wagner, 1997, p. 288). They argue that this skewed perspective of discourse and communication includes the mindset that the second language learner is a "deficit communicator struggling to overcome an underdeveloped L2 [second language] competence, striving to reach the 'target'competence of an idealized NS [native speaker] (Firth

& Wagner, 1997, p. 295). The sociocultural perspective that historically has been overlooked by cognitive theorists recognizes that second language learners are very capable of communicating using a variety of communicative resources that include both linguistic form and social conventions. Using an interdisciplinary lens, that includes a sociocultural epistemology, the communicative resources would be given equal attention within the field of SLA research. Firth and Wagner (1997) propose that this would then lead to new pedagogical models that promote learner-centered, communicative classroom practices. Although the birth of such communicative teaching models had already taken place prior to work of Firth and Wagner, the wide-spread use of these models had not grown. Firth and Wagner (1997) note that the lack of communicative practices had been partly due to the lack of SLA research that recognizes these models as having value. They conclude with a call for a re-conceptualization of SLA research that includes a multi-disciplinary approach that considers the importance of both language as a symbolic system and language as a means to make sense of our world.

In the 10 years since Firth and Wagner published their call for change, there has been a slow shift in the paradigm for teaching and researching second language acquisition. The line between the cognitive sciences and the social sciences is still present, but there has been evidence of an interdisciplinary approach to SLA that includes both the cognitive sciences and a sociocultural lens. Part of this evidence is due to the advancements in neuroscience that have given new breath to the long-time quest to understand how learning occurs, and in particular, how the human brain acquires languages. However, these advances would not have had the pedagogical implications without redefining the concept of intelligence.

Redefining Intelligence

Connecting the advances in brain research to a sociocultural perspective of intelligence would be seemingly impossible without acknowledging the work of David Sousa (2006) and Marilee Sprenger (2003). Sousa's (2006) publication, *How the Brain Learns,* and Sprenger's (2003) *Differentiation through Learning Styles and Memory,* create a unity between brain research and pedagogy. Sousa (2006) elaborates on recent research findings for information processing and memory retrieval that support re-defining the concept of intelligence. Specifically, he recognizes the 1980's as a period when Howard Gardner's seminal work on the theory of multiple intelligences (MI) and Robert Sternberg's patterns of intelligence changed how many in the field of education viewed human intelligence.

Prior to MI theory, the study of human intelligence was essentially limited to intelligence quotient (IQ) tests that sought to measure one general mental ability called the *g* factor (Sousa, 2006). For many, including Howard Gardner (1993), the IQ tests of the 1980's were a mere measure of one's academic success rather than a true test of human capabilities for problem solving. Initiatives for changing this long-time perception of what constitutes intelligence has had varied results. Yet, Gardner (1993) says, "only if we expand and reformulate our view of what counts as human intellect will we be able to devise more appropriate ways of assessing it and more effective ways of educating it" (p. 4). In order to create a theory that supported more than one general, academic intelligence, Gardner (1993) insisted that a theory of multiple intelligences ought to "capture the gamut of the kinds of abilities valued by human cultures" (p. 63). For Gardner (1993), there are 8 raw, innate cognitive capacities that every individual has at birth. They include: bodily-kinesthetic, naturalist, visual, linguistic, interpersonal, intrapersonal, logical-mathematical, and musical intelligences. How these intelligences develop depend upon

how they are activated or discouraged (Gardner, 1993; Sousa, 2006). This can vary from culture to culture. To fully understand how an intelligence can be activated and developed, Sousa (2006) draws upon the research that supports how the brain learns.

Making Brain Research Matter

Sensory Processing, Memory Retrieval, and Intelligent Acts

Acting intelligently includes the ability to process new information and the ability to retrieve old information from memory (Sousa, 2006). In general terms, Sousa (2006) and Sprenger (2003) offer similar outlines for how we process and store information. First, new information is constantly being received through the five senses. This sensory information is immediately sent to association cortices that include the visual cortex, the auditory cortex, and the somatic cortex. Each cortex then sends the information to the rhinal cortex, an area that serves as a convergence zone where the various sensory messages form one mental representation (Sprenger 2003). From the rhinal cortex, the sensory messages are sent to the hippocampus, where these representations are further conceptualized, or made meaningful to the individual (Sprenger, 2003; Sousa, 2006).

The processes of representation in the rhinal cortex and conceptualization in the hippocampus described by Sprenger (2003) are closely related to Sousa's (2006) criteria for long-term memory storage. According to Sousa (2006), the hippocampus is the area of the brain that converts a learning event from short-term memory to long-term memory. Successful transmission to long-term memory requires an event to either *make sense* or *have meaning* to the individual learner (Sousa, 2006). A learning event makes sense if the learner can connect it to a prior learning experience. That same learning event is said to have meaning if the purpose for remembering it is relevant to the learner. What is deemed relevant to a particular learner is

dependent upon individual life experiences. Sousa (2006) also says that the processes of sense making and creating meaning act independently. However, it is believed that creating meaning is the stronger of the two criteria as it lends to a greater probability that a learning event will be stored in long-term memory (Sousa, 2006; Sprenger, 2003).

By applying this notion to sociocultural theory, the value these experiences have may vary from culture to culture. Robert Sternberg's (2007) work in the area of intelligence and cultural differences has exposed the importance of recognizing that learning events do not always share the same value across cultural lines. A learning experience that is highly valued in Western culture may not have the same value in an Eastern culture. This means that two students from different cultures may perceive the same learning event through two completely different lenses. Unless that lens places a high value on the new information, the individual learner may not perceive it worthy for long-term memory. The pedagogical implications of Sternberg's (2007) work will be addressed later in a discussion on the pedagogical implications of brain research on SLA. However, the present discussion returns to the next logical step in re-defining intelligence, which is to gain an understanding for how the brain retrieves information that is stored in long-term memory.

Memory retrieval occurs either by recall or recognition (Sousa, 2006). Sousa (2006) offers an apt explanation of the two. He says that recognition occurs when the brain matches an outside stimulus that directly correlates to an event stored in long-term memory. Recall is the more difficult of the two as it requires the brain to make a connection using only cues or hints, rather than a direct stimulus. How quickly one is able to recognize or recall a learning event has historically been associated with intelligence. It was perceived, and perhaps still is by some, that a person with higher intellect is able to retrieve items from long-term memory more rapidly than

an individual with a lower IQ. The correlation between intelligence and retrieval can now be refuted using a sound argument supported by brain research.

Sousa (2006) notes that how quickly one learns and how rapidly one is able to retrieve that newly acquired material are independent of one another. The research shows that there are an infinite number of possible neural connections that might occur during the processing of new information. Independent of these neural connections are a separate unlimited number of neural networks involved with taking information from the hippocampus and depositing it in long-term memory. Recent research using positron emission tomography (PET) scans have measured the neural efficiency of memory retrieval. Sousa (2006) reports that the PET scans have shown that the speed at which the brain can retrieve information is less about how long it took to initially process that information and more about how efficient the brain becomes at using those neural retrieval networks over time (Sousa, 2006). Therefore, the more meaningful new information is to the individual learner, the quicker it is processed and stored in long-term memory. And, the more the brain is asked to recognize or recall information using the various neural networks, the more efficient it becomes at retrieving that information.

The pedagogical implications of this type of brain research are tremendous. First, there is strong support for Gardner's (1993) multiple intelligences, as the findings show an infinite number of ways an individual can process and retrieve information. Because both of these processes involve unlimited combinations of neural connections, the more educators differentiate instruction and assessment, the more likely they are to accommodate the multiple intelligences proposed by Gardner. For educators, the message is very clear. Using traditional methods of instruction, that appeal to only the intrapersonal, logical, and linguistic intelligences will no longer suffice. Both Sprenger (2003) and Sousa (2006) recognize the need for using multi-

modal, multi-sensory methods to help learners process new information as well as multi-modal, multi-sensory methods to help learners retrieve that information on assessments. The challenge now is how best to apply this new definition of intelligence and this new understanding for how the brain learns to the field of second language learning.

Intelligent Acts and SLA: Connections to Sociocultural Theory

Defining Learner Diversity

To address the call for an interdisciplinary approach to SLA requires one to revisit the question of what defines an intelligent act with consideration to the diversity of today's learners. The first question that comes to mind is what is meant by learner diversity. Traditional definitions of diversity have addressed the ethnic or cultural differences among learners. Now, after the inception of Gardner's theory of multiple intelligences, many in education have expanded their definition to include the cognitive and linguistic differences among learners. This was an important change as it led to more innovative instructional methods that placed the learner at the center of instruction. However, there has been a persistent disconnection between culture and cognition.

As stated earlier, the work by Robert Sternberg has challenged educators from various disciplines to recognize that what constitutes and intelligent act may differ from culture to culture. In his 2007 article, "Who Are the Bright Children? The Cultural Context of Being and Acting Intelligent", Sternberg notes that his past and present studies have shown a rather significant difference between the conceptions of intelligence held by Taiwanese Chinese culture, Mayan culture, Kenyan culture, Yup'ik Eskimo culture, and how Western cultures, including the United States, define and test for intelligence. For example, the concept of intelligence that is held by many areas in the United States includes practical problem solving,

social competence, and verbal ability, while intelligence among rural Kenyans includes knowledge and skills, respect, initiative, and comprehension for handling real-life problems (Sternberg, 2007). The differences between cultures and how they regard an intelligent act become an issue in the classroom when a teacher does not share the same past experiences as the student. Often, the student who shares the same or similar views of intelligence and academic experiences as the classroom teacher is rewarded, while the student who brings a drastically different set of academic experiences is regarded as less bright, and is either ignored or penalized for it (Sternberg, 2007).

Accommodating the needs of the diverse learners in today's classrooms will require more than an understanding of MI theory and knowledge of how the brain learns. It requires educators and those conducting educational research to question and re-evaluate what constitutes an intelligent act so that what is valued might include non-Western views. For Bourdieu (1991a, 1991b) and Hall (2002), changing these shared values will not come easily because they are held deeply by each individual within the group. However, with the education of diverse learners at stake, the call for change cannot be ignored.

Particularly, educators in the field of SLA need to explore how an intelligent act is defined with respect to learning a language. Is it how well a learner can process and retrieve grammar structures? Is it how efficiently a learner is able to communicate by using new language skills in various social contexts? Or, is it a combination of the two? And, how can SLA educators and researchers address diversity with respect to the cultural, cognitive, and linguistic differences that the learner brings to the classroom. The foundation for answering these questions has already been laid by the multiple intelligence research of Marjorie Hall Haley and

work of Teresa Kennedy, who has recently applied brain research directly to the instruction of second languages.

Cognitive, Linguistic, and Culturally Diverse Learners: The SLA Experience

Bringing these new concepts of intelligence and brain-based teaching and learning to the language classroom has been a slow process. The paucity of research may be due in part to the slow response of those in the field of SLA to acknowledge these developments as viable factors in the learning of second languages. Though one is able to find a plethora of publications on the general application of social learning theory and learner-centered instruction, there is less evidence of actual research for the application of MI theory and brain-based teaching and learning specifically to language education. There are even fewer studies that include the recognition of the cognitive, linguistic, and cultural diversity among learners that now populate the foreign/second language classroom. One of the first researchers to address the SLA experience of diverse learners is Marjorie Hall Haley.

Hall Haley's series of multiple intelligence research studies (MIRS) in the field of foreign languages began with a pilot study of 15 teachers and 450 students that set to "create and disseminate a collection of instructional strategies and alternate forms of assessment that activated the eight intelligences" (Hall Haley, 2001, p. 356). In this pilot study, Hall Haley collected quantitative and qualitative data for an experimental group that used learner-centered instructional strategies based on MI theory, and a control group that used teacher-centered instructional methods such as rote memorization drills. The quantitative data on student achievement were susceptible to extraneous factors, such as differing grading policies among the 15 teachers. However, the qualitative data revealed that students and teachers alike responded positively to the variety and flexibility of instructional practices based on MI theory (Hall Haley,

2001). In reviewing the descriptions of the instructional materials used in Hall Haley's studies, it is evident that the MI-based materials included typical grammar and vocabulary for each grade level. Yet, they were predominantly communicative and leaner-centered in nature. This serves as evidence that Firth and Wagner's (1997) call for placing equal value on communicative competencies and linguistic form is possible in SLA practices. Furthermore, the Hall Haley MIRS project supports Sternberg's (2007) notion that intelligent acts differ from culture to culture. Hall Haley (2001) states that "teachers who plan and organize instruction around the learning preferences of individual learners, emphasizing special strengths and shoring up underutilized gifts and talents, may unlock the full learning potential of their students" (p. 360). Even in light of this clear evidence for a more culturally responsive pedagogy in the field of SLA, Kennedy (2006) notes that "the fact remains that the most difficult task for children and adults alike may be the attempt to acquire second language proficiency in academic environments" (p. 479). If Kennedy is correct, and learning a second language in an academic setting is one of the most difficult tasks for any learner, then how can researchers and educators in the field make a difference?

In the few years since Hall Haley conducted the MIRS project, there have been a growing number of researchers who have taken up the call for applying MI theory and brain-based teaching and learning to the foreign/second language classroom. Of particular note is the recent work of Teresa Kennedy. Kennedy's (2006) approach for teaching a second language focuses on content-based instruction. She believes that by making connections between the language classroom and what students are learning in their other subject areas will facilitate the learner's ability to make sense or create meaning across subject area lines. The more connections a learner can make to new information, the more likely it will make sense or have meaning, and thus

facilitating the conversion of new information to long-term memory (Sprenger, 2005; Sousa, 2006). By allowing for numerous multi-modal, multi-sensory learning experiences, the teacher can provide the learner with the necessary repetitive acts of recognition and recall that will eventually expedite memory retrieval (Sprenger, 2003; Sousa, 2006). In essence, the success of any language learner is greatly dependent upon how the teacher perceives intelligent acts (Sternberg, 2007) and how well the teacher appeals to the learner's multiple intelligences by providing multi-modal, multi-sensory instruction and assessment practices (Gardner, 1993; Hall Haley, 2002, 2004; Sousa, 2006).

Conclusion

This literature review began with a quote from Bourdieu that advises against a one dimensional view for understanding the meaning of words. Similar to Bourdieu's call for a multi-dimensional view of language and culture is Firth and Wagner's (1997) call for a multi-disciplinary approach to SLA research. In the last decade, many researchers have sought to answer these calls for change. Most recently, the application of MI theory and brain research to SLA practices has shown that students with diverse cognitive, linguistic and cultural backgrounds respond positively to learner-centered activities that are multi-modal and multi-sensory.

Although brain-based teaching and learning is in its nascent stage, there is significant evidence that one's culture is a critical component for sensory processing and long-term memory storage. Sternberg's work has shown that what is valued in one culture may not have value in another. Therefore, the same learning event may very well be viewed differently by two individuals with different cultural backgrounds. To address this issue, Sternberg (2007) challenges educators to develop a multicultural perspective of intelligence. To do so will require

educators to change their long-held beliefs and values of how teaching and learning should occur. For the field of SLA research, following a multidisciplinary epistemology should also include Sternberg's recommendations. This can be accomplished by using a sociocultural lens that questions two areas. First, those in SLA should recognize the gap that often exists between teacher and student with respect to diversity. Second, both educators and researchers should work in collaboration to close that gap without reverting back to a prescriptive curriculum the fails to recognize the individual needs of diverse learners.

Final Reflection

"It is less about the final product and more about the journey."

(Joan Isenberg, 2006 Doctoral Seminar)

Writing this literature review has been quite difficult. I believe my struggle has been directly related to my desire to understand my own developing epistemologies and my desire to narrow my focus on a dissertation topic. Having read Bourdieu and Firth & Wagner in the Ways of Knowing course, I could see my own epistemologies for SLA were changing. Also affecting my changing views has been the research by Sternberg on the call for a multicultural perspective of intelligence. I knew that the epistemologies that I wanted to draw upon included sociocultural theory, applied linguistics, cognitive theory, and the neurosciences. The challenge was to make connections between these various epistemologies and to develop a contextualized framework for my literature review.

Looking back, my initial approach to writing this paper was far too broad. In my attempt to delve deeper into the various epistemologies, I had read articles on the attitudes of minority students in second language classrooms; on cross-cultural differences in the learning styles of English language learners; on linguistics and the study of language education; and on the needs of a generation of learners that have been raised in the era of the Internet. I spent a few weeks writing, but I lacked focus. I simply could not make the connections between these readings without first laying some type of foundation. In a conversation I had with another doctoral student, I was grateful to learn that she too had struggled with her first attempt as starting a literature review. Her advice was to keep my reference list short and to select references that I could explore in more depth. After our conversation, I realized that perhaps the articles I had

read during my initial approach to this paper were not the right articles for me to build the foundation for my literature review. I had to start over.

Walking away from a project or paper to give myself time to re-think my approach has always been difficult. I am not sure that I have ever been able to do so. Yet, it is probably the single most important thing I could have done in the last 40 days. I remembered the words of Dr. Joan Isenberg, who facilitated the course affectionately known as "Docs on Parade." She said something to the effect that it is less about the final product, i.e. the dissertation, and more about the journey, i.e. what is learned along the way. As I began to write for the second time, I thought less about the articles I had read over the summer and more about defining the lens from which I would view them. Though a process of analysis and synthesis, I believe that I have identified the path for my own epistemologies. What has emerged is not necessarily a contextualized framework for my dissertation topic, but a contextualized framework for how I will approach that topic.

Annotated References

Bourdieu, P. (1991a). Authorized language. In J. B. Thompson, G. Raymond & M. Adamson, (Ed. & Trans.), *Language and symbolic power* (pp. 107-116). Cambridge, MA: Harvard University Press.

The book *Language and Symbolic Power* contains a compilation of writings by the well-known French sociologist, Pierre Bourdieu. The editor, J.B. Thompson, has organized these selected writings with the goal of walking the reader through Bourdieu's framework for understanding the social and political factors involved with language use. This particular article was selected because it provides Bourdieu's explanation for the meaning of words. For Bourdieu, the manner in which an individual derives meaning from words is largely dependent upon his social position.

Bourdieu, P. (1991b). The production and reproduction of legitimate language. In J. B. Thompson, G. Raymond & M. Adamson, (Ed. & Trans.), *Language and symbolic power* (pp. 43-65). Cambridge, MA: Harvard University Press.

This selection from *Language and Symbolic Power* (see above) was chosen because of its discussion of what is perceived to have value by social groups. In particular, Bourdieu describes how a legitimate language emerges as having more value than other languages that are spoken within the same society. Yet, how a language emerges as the "legitimate" is only half of the story. In this piece, Bourdieu also supplies the reader with an understanding of how individual members of a social group contribute to the perpetuation of the legitimate language over extended periods of time.

Firth, A. & Wagner, J. (1997). On discourse, communication, and (some) fundamental concepts in SLA research. *The Modern Language Journal,* 81*,* 285-300.

The selection of this article was made because many in the field of SLA believe it to be a landmark argument for a more holistic approach to SLA. Primarily, the authors reflect upon the history of the imbalance between the cognitivist and socialist approaches to the teaching and learning of languages. They argue that the cognitivist view, which has been dominant in SLA research, has placed the beginning language learner in a deficit position where s/he is constantly struggling to achieve the competencies of a native speaker. By illustrating the findings of their own work, as well as other SLA researchers, Firth and Wagner note that even the most novice language learner is able to use their limited understanding of the language to communicate in real-life social situations.

Gardner, H. (1993). *Frames of mind: The theory of multiple intelligences.* (Rev. ed.) New York: Basic Books.

Gardner's theory of multiple intelligences provides an alternative to the traditional view of the human mind. This seminal work offers the rationale for eight intelligences that are defined as cognitive processes in the brain that operate and develop based on biological and cultural influences. According to Gardner, the impact of cultural influences on intelligence had been missing from the previous

models of intelligence. He believes that this omission has led to a limited view of intelligence which has also impacted our methods for teaching and testing in education. Although Gardner's work has received criticism because it cannot easily be objectively and quantitatively tested, many in the field of education lend credence to his work based on their experiential knowledge of teaching and learning. In recent years, brain research has offered new support to Gardner's theory. For this paper, *Frames of Mind* was used as a primary source for making many connections between language, culture, and cognition.

Hall, J.K. (2002). Teaching and researching language and culture. London, England: Pearson Education Limited.

In this book, Joan Kelly Hall provides a contemporary view of applied linguistics by addressing the role of language and culture. The first five chapters were particularly relevant to this paper as Hall provides a sociocultural perspective that includes such topics as language and identity, the interrelationship of language learning and culture, and the impact of the sociocultural world of each individual learner on classroom culture. Hall's presentation of a sociocultural perspective for language education was the necessary connection between the work of Bourdieu on language and symbolic power and the arguments made by Firth and Wagner for a re-conceptualization of SLA research.

Hall Haley, M. (2001). Understanding learner-centered instruction from the perspective of multiple intelligences. *Foreign Language Annals,* 34, 355-367.

The application of MI theory to the second language classroom was first conducted by Marjorie Hall Haley. She conducted a series of MI studies over a period of years the crossed languages, grade levels and geographical areas. This article reports on the pilot study that included 15 teachers and 450 students. Her findings support the use of multi-modal, multi-sensory materials that appeal to all 8 intelligences. In addition, Hall Haley made one of the earliest calls for language teachers to recognize the underutilized skills and talents of the diverse learners in their classrooms.

Hall Haley, M. (2004). Learner-centered instruction and the theory of multiple intelligences with second language learners. *Teachers College Record,* 106, 163-180.

This article was selected primarily to support the findings of Hall Haley's series of research studies that applied MI theory to the second language classroom. Of particular interest in this later MI study was Hall Haley's focus on teacher attitudes towards their own teaching. The concept of teachers as reflective practitioners is important, not only for teachers to reflect upon their day to day teaching practices, but to also reflect upon their teaching philosophies.

Kennedy, T.J. (2006). Language learning and its impact on the brain: Connecting language learning with the mind through content-based instruction. *Foreign Language Annals,* 39, 471-486.

The recent work of Teresa J. Kennedy has focused on the application of brain research to the teaching and learning of second languages. This article was

selected because Kennedy provides a brief summary of how the brain learns by reviewing brain plasticity theory and the parts of the brain dedicated to language. Although the research on how the brain learns languages is in its nascent stage, Kennedy recognizes that there are specific teaching methods that language teachers can implement to facilitate a learner's ability to make sense and give meaning to new information. She proposes a content-based approach to instruction that will offer the learner multiple opportunities to connect new information with prior learning experiences.

Sousa, D. (2006). *How the brain learns* (3rd ed.). Thousand Oaks, CA: Corwin Press.
This book served as the primary reference for the sections of this paper devoted to making brain research matter. Regarded as one of the first to apply brain-research to everyday topics in education, Sousa provides a comprehensive discussion for how the brain learns by referring to both the historical events in brain research and the most current findings. His presentation of brain research is used to address topics that are of interest to educators, such as sensory processing, memory storage and retrieval, transfer, and brain specialization. In addition to being the main resource for brain research, Sousa's work was also used to re-define the concept of intelligence.

Sprenger, M. (2003). Differentiation through learning styles and memory. Thousand Oaks, CA: Corwin Press.
Sprenger uses recent findings in brain research to support the call for differentiated instruction. She provides a clear and concise understanding of sensory processing and how it can be applied to classroom practices.
This text served as a secondary source for the discussion on making brain research matter as it re-enforced the concepts and processes presented by David Sousa.

Sternberg, R. (2007). Who are the bright children? The cultural context of being and acting intelligent. *Educational Researcher, 36(3),* 148-155.
This article was selected because it takes the existing view of student diversity to a new level. It poses the question, what constitutes intelligence? In his own research and in the work of others, Sternberg has found that many cultures share differing perspectives on what constitutes an intelligent act. In this particular article, he calls on U.S. teachers to recognize non-Western views of intelligence. This will facilitate their ability to build upon the prior knowledge and skills that their students from non-Western cultures bring to classroom.