The Influence of Neuroscientific Findings

On Educators of Adults

by

Elizabeth Maggio

Submitted in partial fulfillment of the requirements for the Degree of

Master of Arts

in

Organizational Psychology

at

John F. Kennedy University

September 2, 2009

Approved:

____________________________________  ______________________________________
Advisor/Research Coordinator  Date

____________________________________  ______________________________________
Second Reader  Date
Table of Contents

Introduction 4
Literature Review 8
Research Methodology 47
Results 55
Discussion 117
Summary and Recommendations 136
References 141
Appendix A 148
Appendix B 149
Appendix C 151
Appendix D 154
### Table of Tables

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 1</td>
<td>Adult Learning Theories – Purpose of Learning</td>
<td>16</td>
</tr>
<tr>
<td>Table 2</td>
<td>Adult Learning Theories – The Learning Process</td>
<td>17</td>
</tr>
<tr>
<td>Table 3</td>
<td>Adult Learning Theories – Role of the Teacher</td>
<td>19</td>
</tr>
<tr>
<td>Table 4</td>
<td>Adult Learning Theories – Role of the Learning Environment</td>
<td>21</td>
</tr>
<tr>
<td>Table 5</td>
<td>Basic Information About Research Participants</td>
<td>55</td>
</tr>
<tr>
<td>Table 6</td>
<td>Experience in Working with Adults (SQ1)</td>
<td>57</td>
</tr>
<tr>
<td>Table 7</td>
<td>Factors that Impact Work With Adults (SQ2 a-i)</td>
<td>58</td>
</tr>
<tr>
<td>Table 8</td>
<td>Psychological Theories of Adult Learning (SQ3,4)</td>
<td>60</td>
</tr>
<tr>
<td>Table 9</td>
<td>Learning-Related Brain Research (SQ6,7)</td>
<td>61</td>
</tr>
<tr>
<td>Table 10</td>
<td>Implementation vs. Interpretation (SQ9a)</td>
<td>63</td>
</tr>
<tr>
<td>Table 11</td>
<td>Types of Student (IQ1a)</td>
<td>67</td>
</tr>
<tr>
<td>Table 12</td>
<td>Subject Matter (IQ1a)</td>
<td>67</td>
</tr>
<tr>
<td>Table 13</td>
<td>Length of Event (IQ1a)</td>
<td>68</td>
</tr>
<tr>
<td>Table 14</td>
<td>New vs. Repeat Audience (IQ1b)</td>
<td>68</td>
</tr>
<tr>
<td>Table 15</td>
<td>Work Alone or With Others (IQ1c)</td>
<td>69</td>
</tr>
<tr>
<td>Table 16</td>
<td>Designers of Curriculum (IQ1d)</td>
<td>69</td>
</tr>
<tr>
<td>Table 17</td>
<td>Indicators of a Successful Event (IQ1e)</td>
<td>70</td>
</tr>
<tr>
<td>Table 18</td>
<td>Preferred Methodologies (IQ2a)</td>
<td>74</td>
</tr>
<tr>
<td>Table 19</td>
<td>Curriculum Elements (IQ2b)</td>
<td>76</td>
</tr>
<tr>
<td>Table 20</td>
<td>Preparation (IQ2b)</td>
<td>78</td>
</tr>
<tr>
<td>Table 21</td>
<td>Presentation (IQ2b)</td>
<td>82</td>
</tr>
<tr>
<td>Table 22</td>
<td>Processing (IQ2b)</td>
<td>85</td>
</tr>
<tr>
<td>Table 23</td>
<td>Practice (IQ2b)</td>
<td>93</td>
</tr>
<tr>
<td>Table 24</td>
<td>Promotion (IQ2b)</td>
<td>93</td>
</tr>
</tbody>
</table>
Table 25  Post-Event Promotion Possibilities (IQ2b) 94
Table 26  Typical Times Frames During Events (IQ2b) 95
Table 27  Participant Functional Roles During the Event (IQ3) 100
Table 28  Teaching in the Moment vs. Staying with the Agenda (IQ4a) 102
Table 29  Greatest Influences on Long-Term Learning (IQ4b) 103
Table 30  Participant Focus of Attention During an Event (IQ5a) 106
Table 31  Participant Interest in Adult Learning (IQ6b) 109
Table 32  Participant Practices Before Integrating Brain-Related Research (IQ6c) 110
Table 33  Participant Practices After Integrating Brain-Related Research (IQ6c) 111
Table 34  Topics not Covered Earlier in the Interview (IQ7) 113
Table 35  Comparing Participant Event Elements with Adult Learning Theory and Neuroscientific Research Descriptions from the Literature Review 129

Table of Charts

Chart 1  Event Timeline 76
Chart 2 Curriculum Elements 96
Chart 3  Long-Term Learning P2 104
Chart 4  Long-Term Learning P5 104
Chart 5  Long-Term Learning P3 104
Chart 6  Long-Term Learning P1 104
Introduction

Learning is integral to who we are as human beings. It is the vehicle by which we develop as individuals, as well as how we pass on our culture and civilization through the generations (Kandel & Hawkins, 1999). As a result, it has been the subject of study for hundreds of years by philosophers such as Socrates and Aristotle (Russ-Eft, 2004); psychologists such as Skinner, Piaget, Maslow; educators such as Kolb, and more recently, cognitive neuroscientists and biologists such as Zull and Cozolino (Johnson & Taylor, 2006).

Most of the research and theories about learning have come out of the field of psychology, based on the observation of both human and non-human subjects as they learn. Interpretation and application of these theories has primarily come from psychologists and educators, and these findings have in turn, directly or indirectly, been implemented and fine-tuned over the years through the experience of educators in the classroom.

Over the last 20 – 30 years, technological advancements in Magnetic Resonance Imaging (MRI)¹ and functional Magnetic Resonance Imaging (fMRI)² have made possible previously unattainable neurological discoveries of how the brain works and what happens in our brains when we learn. However, the reaction to these new findings and their potential application to the study of learning have been mixed, and the literature from the fields of psychology, education and even cognitive neuroscience reflects a variety of strong opinions on the relevance or intersection of these perspectives (Jensen, 2008a, 2008b; Willingham, 2006, 2008, Sternberg, 2008). Byrnes & Fox (1998) have studied these positions and described the responses as falling into four camps:

---

¹ MRI is a diagnostic scanning system that uses powerful magnets to produce images of soft tissues in the body. MRI is especially effective for producing images of the brain and spinal cord. (Biology, 2005)
² fMRI is a relatively new MRI technique that studies brain function. Using fMRI technology, scientists can determine which part of the central nervous system (CNS: brain and spinal cord) is active during a given task by tracking blood oxygen levels in the brain. (Biology, 2005)
INFLUENCE OF NEUROSCIENTIFIC FINDINGS ON EDUCATORS

- those who are unfamiliar and indifferent to the new findings
- those who reject the work and find it meaningless in the context of adult learning
- those who readily accept and sometimes over-interpret the results of the neuroscientific findings and
- those who cautiously explore the findings as part of a total pattern of developments in the cognitive sciences.

The diversity in the responses reflects, in part, the reality that neuroscientific discoveries are pure research and not easily translated directly into successful classroom strategies.

Renowned neuroscientist Patricia-Goldman Rakic (1996, cited by Taher, 1996, p.2) places the burden of translation on educators, “Research [findings in neuroscience] must surely have some implications for how we approach education. Now educators must tell us what they are.”

Educators such as Caine (2005), Jensen (2008) and Dennison (2006), have begun to interpret findings from neuroscience and create methodologies for work in the classroom, especially K-12. Some educators and school districts herald their approaches and believe they provide a great breakthrough, citing empirical success in the classroom. Concurrently, there are neuroscientists who warn educators “many brain research findings might be too narrow and isolated to ever provide a detailed plan of action for restructuring schools” (McCandliss, n.d.).

Another methodology that utilizes neuroscientific findings is Accelerated Learning (AL). Although its roots are in the work of Lozanov (a clinical psychiatrist), AL also incorporates research on the Triune Brain (McLean), as well as other “modern brain research” (Meier, 2000, p. 33). Dave Meier (2000) and Colin Rose (1997) have applied the Accelerated Learning approach to the corporate learning environment, and Rose has applied it to the teaching of foreign languages. Meier has shown that the application of his Accelerated Learning program
generated substantial improvements in employee performance at Bell Atlantic Telephone (Meier, 2000). In addition, AL is increasingly used by universities whose students are working adults – the Regis University’s Center for the Study of Accelerated Learning has found at least 250 schools offering courses designed with AL (Wlodkowski, 2003).

Many neuroscientists and educators alike agree that it is the combined and joint efforts of individuals from psychology, education and neuroscience that will lead to the best integration of brain-related findings into the learning environment (Taher, 1996). Eric Jensen (2008a, p. 9), a proponent of brain-based education, states it this way:

> At issue is not whether any educator has learned a revolutionary new strategy from the brain research. Teachers are highly resourceful and creative; literally thousands of strategies have been tried in the classrooms around the world. The issue is, can we make better-informed decisions about teaching based on what we have learned about the brain?

Adult educators looking to incorporate the findings of cognitive neuroscience into their work face two primary questions:

- To what extent does the interpretation of cognitive neuroscience research affirm or disaffirm what teachers of adults are already doing?
- How have interpretations of neuroscientific findings changed the way educators teach adults?

My interest in these findings is personal. As an educator of adults, I often seek new ways of teaching that are effective, long lasting, and enjoyable. I was first exposed to the use of brain-based techniques about a year ago, and it began to shift my perspective on learning and on
the work that I do with students. It is my hope that this study will enable me to explore further how brain research can be integrated into the teaching of adults.
Literature Review

In determining what to include in the Literature Review, different criteria were considered: Should the review cover the neuroscientific research, its interpretation for use in learning environments, or both? Should the review cover only brain-related information or should it provide the reader a foundation of adult learning theory from which to compare the new findings? After careful deliberation, this researcher decided that the differences promoted by brain-friendly teaching practices could be better appreciated in relation to the work that had already been developed through adult learning theories. In addition, I only included neuroscientific research considered important by people in the field who were already exploring and testing its use in the classroom.

This section begins with a review of the literature on adult learning theory and follows with a review of published brain-friendly methodologies. At the end, the review explores what has been written about the overlap between the two.

Review of Adult Learning Theories

A review of the study of adult learning is by no means a clear-cut endeavor. Learning has been studied in a scientific way for over a hundred years. During that time, numerous theories and models have been developed to describe what learning is, as well as how and why people learn. The literature often disagrees on what schools of thought are actually theories versus models or principles, and which are distinct enough to be considered a distinct theory. In addition, there is dispute over which are theories of learning versus theories of teaching (Gage, 1972; Knowles et al, 2007), learners’ development, or cognition (Knowles, 2007; Ormond, 2004; and Merriam Caffarrella & Baumgartner, 2007). To complicate matters further, the work of specific theorists can be assigned to one category of adult learning theory by some interpreters.
and to another by other interpreters. Malcolm Knowles (one of the foremost theorists on adult learning) put it this way, “Researchers have exerted considerable effort in their attempts to structure the system [of learning theories]. For instance, Hilgard and Bower identify eleven categories of theories; whereas McDonald identifies six and Gage names three” (Knowles et al., 2007, p. 20-21). Jeanne Ellis Ormond (author of the definitive textbook “Human Learning” and other textbooks on learning) agrees and even lists several others authors such as Salomon, Clancey, Hynd and Sfard (Ormond, 2004, p. 181) who have also written about this frustration. Ormond takes the point further:

Despite the fuzziness of the boundaries between various cognitive perspectives, some psychologists and educators have insisted on drawing sharp distinctions among them. This tendency to dichotomize theoretical perspectives – to portray one as black and another as white … and in some cases to imply that one is a “good guy” and another is a “bad guy” – drives me nuts. (Ormond, 2004, p. 181)

This thesis will not attempt to explore the breadth and scope of the existing work on adult learning, nor will it create its own categorization of the theories and theorists associated with the study of adult learning. Rather it bases the overview on the work of Shannan Merriam (Professor of Education and highly cited author and editor of books and articles on adult learning), who grappled with the same frustrations and came to the following conclusion,

Since there is little consensus on how many learning theories there are or how they should be grouped for discussion, we have organized this … [information] according to orientations that present very different assumptions about learning and offer helpful insights into adult learning. With these criteria in mind, five basic orientations have been selected for discussion, behaviorist, humanist,
cognitivist, social cognitive, and constructivist. (Merriam, Caffarrella & Baumgartner, 2007, p. 277)

In addition, Merriam (et al., 2007; ed. 1993) notes contributions from the following theorists that are also be reviewed in this section: Knowles (Andragogy), Mezirow (Transformational Learning), and Kolb (Experiential Learning).

**Behaviorist.**

The theorists associated with this approach are Guthrie (work on contiguity and attention), Hull (Systematic Behavior), Pavlov (Classic Conditioning), Skinner (Behaviorism), Thorndike (Connectionism), Watson (Behaviorism) (Merriam, Caffarrella & Baumgartner, 2007), and Tolman (Purposive Behaviorism) who is seen as more of a behaviorist with cognitive leanings (Ormond, 2004; Merriam, et al.,2007; Knowles et al., 2007). This school of thought sees the purpose of learning as changing behavior, and learning itself as a reaction to external factors – a learner is stimulated by experiences outside of themselves and outside of their control.

**Humanist.**

Although some consider humanism to be more of a psychological theory than a learning theory (Ormond, 2004), Merriam, et al. (2007) see humanism as the foundation for many later learning models such as Andragogy, Transformational Learning, Self-directed Learning and Student-Centered Learning. The founding theorists include Abraham Maslow and Carl Rogers. Humanists believe that the motivation to learn comes from the learner, who is trying to better themselves either in terms of skills, knowledge or personal growth. Learning from a humanist perspective is an active pursuit of self-actualization. A learner has choices about what and how they want to learn, and the educator’s role is more one of facilitator.
Cognitivist.

Developed in direct response to behaviorism’s view of learning as passive, cognitivism sees people as actively contributing to and changing their learning environment. The major theorists in this field include Ausubel (Subsumption), Bruner (categorization, motivation, and intuition), Gagne (Conditions of Learning), Kofka, Kohler and Wertheimer (organizational processes and problem solving), Lewin (Group Dynamics), and Piaget (Developmental Theory) (Merriam et al., 2007). Although these theorists believe that the mind is influenced by external stimuli, they are more interested in how learners process, remember and work with the information taken in by their senses. Cognitivists also look at how this internal process in turn impacts the experiences learners have, as well as what and how they choose to learn. They see learning as the process by which people develop new skills and abilities.

Cognitivists believe that learning goes beyond the stimulus and response perspective presented by the behaviorists, and that as part of the learning process a person interprets, tries to make sense and finds significance in what they are trying to learn. “Learning involves the reorganization of experiences in order to make sense of stimuli from the environment” (Merriam, et al., 2007, 285).

Social Cognitive.

This study of learning believes that people learn roles and behaviors from observing others. Initially, the work came from a behaviorist framework and learning was described as the result of observation followed by imitation and reinforcement: If you want to teach someone how to do something new, have them see it done, then have them do it over and over again with positive reinforcement. Later work began to explore more cognitive aspects of learning.
Merriam et al. (2007) attribute the move towards a more cognitive perspective to the work of Bandura (Social Cognitive Theory) and Rotter (Expectancy-Value Theory). These theorists agree that observing others was a key component of learning; however, they went beyond the behaviorist perspective (Ormrod, 2004; Merriam, et al., 20007). Bandura and Rotter suggest that learning can occur without an observable change in behavior, learners influence the learning environment, and people can adjust their own behavior. They also believe people observe not only the actions of others but, the outcome of those actions; the values placed on these outcomes affect the learning process. From the social cognitive perspective, people are more likely to want to learn if they think they will have some measure of control in the environment where the learning will be used, and if they believe they can be successful.

**Constructivist.**

The underlying tenet of the constructivist perspective is that “learning is a search for meaning” (Baumgartner, Lee, Birden & Flowers, 2003, p. 9). Although Merriam, et al. list many constructivist theorists, other sources (Ormrod, 2004; Fosnot, 1996) list Piaget (Theory of Learning) and Vygotsky (Social Constructivism) as the major influences in the field. Constructivists describe learning as an internal process where past and new knowledge meet and adapt to create a new base of experience. After the senses take in information, learners try to find a way in which it makes sense for them, based on their existing knowledge base and their life experience to date. Inherent in this orientation is the view of knowledge as individual, temporary and subjective, as well as couched in contemporary social frameworks (Fosnot, 1996 as cited in Yilmaz, 2008). In the constructivist view, the educator creates opportunities and supports learning.
Andragogy.

The first known published work that dealt with the concept of adult education (andragogy) as distinct from the education of children (pedagogy) was by Albert Kapp in 1833 (Reischmann, 2004). Although other educators, such as Eduard Lindeman, wrote about the adult learner, the English-speaking world generally did not accept notion of separating child and adult learning until after Malcolm Knowles began to publish. His works popularized this field of study and ultimately led to his being recognized as “the father of adult learning.”

The study of andragogy continues to develop. Over the years, Knowles and his colleagues have come to identify six core factors that differentiate an adult learning experience from that of a child’s (Knowles, Holton & Swanson, 2007, p. 64-68):

- **The need to know** – Adults need to know why they need to learn something before they invest the time to learn it
- **Self concept** – Adults feel responsible for their own decisions and have a psychological need to be seen as capable and responsible by others, and especially of being self-directed (not to have to be told what to do)
- **Prior experience** – Adults have more and richer life experiences (both positive and negative) coming into any learning environment than most children
- **Readiness to learn** – Adults come with a readiness to learn the things they need to learn to address life or job issues
- **Orientation to learning** – Adults are more motivated to learn when the subject is applicable to their life needs
- **Motivation to learn** – Adult motivation to learn is mostly internal, rather than external.
According to Knowles et al. (2007, p. 3), “Andragogy works best in practice when it is adapted to fit the uniqueness of the learners and the learning situation.” However, one of the critiques of andragogy is that the adult samples used in the studies performed in 1984 were “overrepresented by privileged individuals, who were primarily white, male, educated and from middle-class backgrounds” (Baumgartner, et al., 2003, p. 21), and that resulting overgeneralizations, especially with regard to self-direction and internal motivation, do not represent learners who might feel marginalized.

**Transformational Learning.**

Jack Mezirow developed the Theory of Transformational Learning based on a foundation of constructivist concepts and humanist philosophy (Clark, 1993 in Merriam ed., 1993). The focus of this theory is that learning that transforms the learner on a personal level, resulting in a shift in perspective. As Mezirow explains:

> Reflective learning involves assessment or reassessment of assumptions. Reflective learning becomes transformative whenever assumptions or premises are found to be distorting, inauthentic, or otherwise invalid. Transformative learning results in new or transformed meaning perspectives. (Mezirow, 1991, p. 6)

Other theorists have built on Merizow’s work, such as Brookfield (Student-centered Learning). Educator Maryellen Weimer, in her *Learner-Centered Teaching* (2002), combines elements from Brookfield, constructivism, self-directed learning and cognitive educational psychology.
Experiential Learning.

David Kolb attributes the work of Dewey (higher education), Lewin (training and organizational development) and Piaget (cognitive development) as being the “intellectual ancestors of Experiential Learning Theory” (Kolb, 1984, p. 15). Knowles and Lindeman also state that experience is a fundamental part of adult learning (Wilson in Merriam, 1993). After analyzing the work of Dewey, Lewin and Piaget, Kolb came up with the following definition: “Learning is the process whereby knowledge is created through the transformation of experience” (Kolb, 1984, p. 38). He also outlined four critical aspects of the learning process:

- The process emphasizes adaptation and learning, as opposed to content or outcomes
- Knowledge is a transformation process, being continuously created and recreated, not an independent entity to be acquired or transmitted
- Learning transforms experience in both its objective and subjective forms
- We must understand the nature of knowledge and vice versa.

Comparison of Adult Learning Theories

Each of these theories holds a different perspective on learning. Behaviorists consider only what can be observed; humanists think about the development of the whole person. Cognitivism and andragogy were developed specifically as alternatives to existing theories. Each brings valid and tested observations about certain aspects of learning. The following tables summarize the beliefs of each of these different theories regarding the following issues:

- What is the purpose of learning? (Table 1)
- How does the learner learn? (Table 2)
- What is the role of the learning environment? (Table 3)
What is the role of content? (Table 4)

What are examples of classroom applications? (Table 5)

**What is the purpose of learning?**

Table 1 shows that each theory has a different view on the purpose of learning that ranges from the development of skills (behaviorism) to the development of self (humanism, constructivism, cognitivism), to the development of the social-self (social cognitive, andragogy, Experiential Learning, Transformational Learning).

<table>
<thead>
<tr>
<th>Table 1 Adult Learning Theories – Purpose of Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behaviorist</td>
</tr>
<tr>
<td>Humanist</td>
</tr>
<tr>
<td>Constructivist</td>
</tr>
<tr>
<td>Andragogy</td>
</tr>
<tr>
<td>Transformational Learning</td>
</tr>
<tr>
<td>Cognitivist</td>
</tr>
<tr>
<td>Social Cognitive</td>
</tr>
<tr>
<td>Experiential Learning</td>
</tr>
</tbody>
</table>

**How does the learner learn?**

Table 2 (see p. 17) considers different views on the learning process. Behaviorists and cognitivists see the learning process as initiated and guided by external factors controlled by the teacher. An external factor also triggers Transformational Learning, but in a different way: The external factor causes an internal dilemma for the learner, which in turn initiates the desire to learn. In Social Cognitivism, the learner’s values influence the impact of external factors on learning.
Learning. Cognitivists focus on intellectual learning; behaviorists on behavioral change; and transformational, constructivist and experiential theorists on shifting perspectives. Humanism, andragogy, transformational learning, cognitivism, social cognitivism and experiential learning see learning as a life-long, on-going, interactive process and thus they integrate reflection on prior experience into the learning process.

<table>
<thead>
<tr>
<th>Table 2 Adult Learning Theories – The Learning Process</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Behaviorist</strong></td>
</tr>
<tr>
<td>- Learner is shown what they will be learning</td>
</tr>
<tr>
<td>- An external incentive is given to stimulate learning</td>
</tr>
<tr>
<td>- Learner has a chance to connect new learning to prior knowledge</td>
</tr>
<tr>
<td>- Learner reinforces new learning through practice</td>
</tr>
<tr>
<td><strong>Humanist</strong></td>
</tr>
<tr>
<td>- Learner participates actively in the learning process</td>
</tr>
<tr>
<td>- Learner is responsible for their own learning</td>
</tr>
<tr>
<td>- Learner learns through self-directed, self-actualized methods, and by working with others</td>
</tr>
<tr>
<td>- Learning needs to be relevant to their life</td>
</tr>
<tr>
<td><strong>Constructivist</strong></td>
</tr>
<tr>
<td>- Learner is shown what they will be learning</td>
</tr>
<tr>
<td>- Learner has a chance to reflect on how new learning will fit with prior experiences.</td>
</tr>
<tr>
<td>- Through reflection, the learner constructs a new understanding of how the world works</td>
</tr>
<tr>
<td><strong>Andragogy</strong></td>
</tr>
<tr>
<td>- Learner wants to learn and see a benefit from learning</td>
</tr>
<tr>
<td>- Learners have a focus on learning material that will help them overcome difficulties, or challenges in their life</td>
</tr>
<tr>
<td>- Learners learn from each other and collaborate for on-going mutual support of new learning</td>
</tr>
</tbody>
</table>
Table 2 (cont.) Adult Learning Theories – The learning process

<table>
<thead>
<tr>
<th>Theoretical Model</th>
<th>Description</th>
</tr>
</thead>
</table>
| Transformational Learning | • Learner is confronted by a dilemma, and looks to acquire new skills to support a recognized need for change  
• Learner has observed others go through this same kind of change, and see it can be done  
• Learner wants to try new ways of doing things, build competence, and gain confidence  
• New learning generates a new perspective on the current situation |
| Cognitivist                | • Mind is influenced by external stimuli; however, it is more important to look at how learners process information  
• Learner processes cognitively, trying to make sense of what is being learned given what is already known |
| Social Cognitive           | • Learner observes the behavior of others around them, as well as the consequences of that behavior  
• Learner places certain values on the consequences they observe, and this influences what they learn  
• Learner’s expectations about what they can accomplish influences what they learn  
• New skills are acquired through observation, explanation and hands-on practice in a group setting  
• Reinforcement and reflection are part of the learning process |
| Experiential Learning      | • Learning builds on the concrete experience of the learner  
• Learner wants to learn and reflects on their experience  
• Learner analyzes the experience to determine what they have learned and how it can be applied to future situations  
• Learner actively experiments with the new learning and restarts the cycle |

**What is the role of the teacher?**

In accord with their view on the learner, behaviorism and cognitivism see the role of the teacher as the one who determines what will be learned and how. All the others see the teacher in
more of a facilitator role. Experiential learning can occur even without the teacher’s involvement.

<table>
<thead>
<tr>
<th>Table 3 Adult Learning Theories – Role of the Teacher</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behaviorist</td>
</tr>
<tr>
<td>• Determines in advance what the learner should learn and how</td>
</tr>
<tr>
<td>• Provides all information and modeling</td>
</tr>
<tr>
<td>• Stimulates learning by providing incentives (or disincentives) so that learners will learn what needs to be learned and in the right way</td>
</tr>
<tr>
<td>Humanist</td>
</tr>
<tr>
<td>• Facilitates development of the whole person</td>
</tr>
<tr>
<td>• Respects each learner as an individual on their own path to learning</td>
</tr>
<tr>
<td>• Empowers the learner and helps build their sense of confidence</td>
</tr>
<tr>
<td>Constructivist</td>
</tr>
<tr>
<td>• Understands that each learner holds their own world-view</td>
</tr>
<tr>
<td>• Presents information in a way that is appropriate for the learner</td>
</tr>
<tr>
<td>• Coaches the learner as they analyze and make sense of the material</td>
</tr>
<tr>
<td>• Encourages the learner to discover new learning from the information presented</td>
</tr>
<tr>
<td>Andragogy</td>
</tr>
<tr>
<td>• Creates awareness of the benefits and relevance of learning</td>
</tr>
<tr>
<td>• Provides strategies and resources to facilitate group learning</td>
</tr>
<tr>
<td>• Develops a framework for the facilitation of learning</td>
</tr>
<tr>
<td>• Becomes a resource for learning</td>
</tr>
<tr>
<td>Transformational Learning</td>
</tr>
<tr>
<td>• Determines what is important to the learner</td>
</tr>
<tr>
<td>• Fosters learner independence and group learning: decision-making, self-awareness, self-reflection, self-correction</td>
</tr>
<tr>
<td>• Organizes curriculum based on issues relevant to learner</td>
</tr>
<tr>
<td>• Encourages reciprocal learning experiences and use of supportive resources</td>
</tr>
</tbody>
</table>
Table 3 (cont.) Adult Learning Theories – Role of the Teacher

| Cognitivist | • Evaluates learners needs and abilities and determines what should be taught and how  
|             | • Delivers content  
|             | • Leaves it up to the learner what they will take away from the learning situation  
|             | • Helps learners find their own way to perform complex tasks  
|             | • Evaluates student performance  

| Social Cognitive | • Facilitates the learning process  
|                  | • Provides correct model for new roles and behaviors  
|                  | • Motivates learning  

| Experiential Learning | • Engages the learner in a realistic experience  
|                      | • Facilitates discussion of feelings and observations generated by the experience  
|                      | • Supports learner analysis and self-reflection about what they learned  
|                      | • Creates opportunities for learner try out new learning  
|                      | • Promotes cycle of experiential learning  

What is the role of the learning environment?

The concept of environment encompasses factors outside of the learner that affect the learning process. Each adult learning theory recognizes the interaction between learner and environment; however, each theory may consider different factors irrelevant. The theories also assign the teacher the role of setting up the environment in a way that is supportive to learning. Behaviorist teachers are expected to control environmental factors and keep the general atmosphere free from stress. Experiential teachers prefer to create an environment where learners can be immersed in the process as much as possible.
**Table 4 Adult Learning Theories – Role of the Learning Environment**

<table>
<thead>
<tr>
<th>Theorist</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behaviorist</td>
<td>Teacher controls the environment and generates stimuli to support the desired behavior change. Environments should not be stressful.</td>
</tr>
<tr>
<td>Humanist</td>
<td>Learners interact with others in their environment. Learning environments should meet a learner’s lower level needs (physiological, safety, belonging, and esteem) so the learner can focus on self-actualization.</td>
</tr>
<tr>
<td>Constructivist</td>
<td>Input from others in the group is integral to the learning process. Learners influence and in turn are influenced by people and things in the learning environment.</td>
</tr>
<tr>
<td>Andragogy</td>
<td>The teacher creates and maintains an environment that is respectful, enthusiastic and stimulating.</td>
</tr>
<tr>
<td>Transformational Learning</td>
<td>Learners influence and in turn are influenced by people and things in the learning environment. Factors in the environment can be a motivating force for change.</td>
</tr>
<tr>
<td>Cognitivist</td>
<td>Learners influence and in turn are influenced by people and things in the learning environment.</td>
</tr>
<tr>
<td>Social Cognitive</td>
<td>Learners influence and in turn are influenced by people in the learning environment. Learning occurs in a social context. The actual or assumed intent of others can affect the learner's thoughts, perceptions, feelings and behaviors. Culture also influences learning.</td>
</tr>
<tr>
<td>Experiential Learning</td>
<td>Learners are immersed in the learning environment. The climate should be invigorating, fun, respectful, encouraging, etc.</td>
</tr>
</tbody>
</table>

**What are examples of classroom applications?**

Over the years, educators have created classroom practices that support the philosophy of each of the above theories. These practices can be seen as supporting the successful accomplishment of certain teaching goals: behavior modification, cognitive processing, self-development, and social integration. As a result, a particular practice (e.g. group discussion), can
be utilized by any adult learning approach that incorporates that teaching goal (e.g. cognitive processing).

Behaviorists, with their focus on behavior modification, rely on observation of teacher demonstration, rote memorization, and memory aids such as mnemonics and analogies. In addition, learning is reinforced through guided practice, drills, repetition and case studies. External incentives include a stress-free learning environment, feedback for reinforcement of correct skill learning, goal setting, and grades (as well as other forms of rewards or consequences).

Humanists want to help the individual attain their full potential; therefore, many practices empower the learner to work things out for themselves. Teachers design exercises that support self-directed work (including goals setting and individual projects) and allow the learner to discover the learning from the material presented. In addition, teachers use internal and external motivators to support the learner’s development.

Constructivist classrooms focus on building learning. Curriculum is customized to the needs of the learner to better support their absorption of material. Many practices allow learners to take in the information through a variety of senses and work with the material hands-on: realistic tasks, discussions, problem solving, discovery of patterns, relationship between the parts and the whole. In addition, the learner is responsible for their own learning and assesses their own progress.

Andragogy builds on the practices used in the Constructivist classroom and adds elements to reinforce group learning such as peer collaboration, sharing past experiences, inclusivity, mutual support groups, collaborative analysis, debates and feedback. Also included are practices designed to help students learn how to learn, such as counseling, modeling,
outlining, orientations, explaining the reasons for learning, and future planning. The focus of the application exercises is to keep them as realistic as possible and to allow the integration of new and prior knowledge through role-plays, field experience, and case studies. In supporting a shift in perspective, teachers also utilize practices to help get learners get unstuck from their current mindset.

Transformational learning practices also combine cognitive processing, learner autonomy, and realistic application in an environment of mutual learning.

- **Cognitive processing** – Discussion, problem solving, discovery, building on prior experience and meaning making
- **Learner autonomy** – Self-directed learning, self-reflection, self-assessment, self-correction, journaling, and learning contracts
- **Realistic application** – Demonstration, applying new knowledge, and decision-making
- **Environment of mutual learning** – Peer collaboration, resource development, and support groups.

Cognitivist practices include those found in a behaviorist environment, such as rote memorization, tests, teacher demonstration, mnemonics, images, symbols, and guided practice. Included are exercises to reinforce cognitive learning, such as problem-solving, critical thinking, modeling, summarizing, and outlining. Additional practices combine both approaches: step-by-step instructions, learner simplification of material, categorizing information, and creating new solutions based on a given structure.

Social cognitive learning emphasizes the individual as part of a community. As such, many practices focus on the connections between things: apprenticeships, whole/parts
relationships, collaboration between learners and teachers, peer collaboration, modeling and imitation, reciprocal teaching, observation of external and internal environments, visioning, as well as the use of metaphors, symbols, and images. Cognitive processing practices include realistic problem-solving, integrating old and new knowledge, applying new knowledge to real situations, and completing realistic tasks. Behavior change approaches such as practice and external motivators are utilized. In addition, there is a focus on self-development through planning for the future, goal setting, and the use of internal motivators.

Experiential learning immerses the learner in the learning environment. Experimentation, mentorships, field studies, internships, mock trials, study abroad, simulations, service learning, and role-play are all examples of experiential learning practices. In the classroom setting, learners interact through discussion, debriefing, cooperative learning, sharing of perceptions and feelings and review. Learning is often self-directed and encourages reflection, extrapolation, and goal setting. Games and other exercises are used to introduce the element of fun, and are then followed by analysis and decision-making.

Summary of Adult Learning Theory

The preceding review of adult learning theories is not comprehensive, but it does provide a good foundation for understanding the major schools of thought on adult learning that have been explored and addressed from a psychological and educational perspective. Over the years, these theories have had their proponents and their critics, and research studies have been used to substantiate and test the principal concepts. Each of these theories, as well as the others not reviewed in this study, brings a slightly different perspective to a complex field. Gagne in The Conditions of Learning (1965, p. v) explores the limitations inherent in describing learning through theories by saying, “I do not think learning is a phenomenon which can be explained by
simple theories, despite the admitted intellectual appeal that such theories have.” Ormord also expresses her doubts, indicating that a theory is often “parsimonious” (2004, p.5), describing in a simple way only the workings of the object of study. Unfortunately, most proponents of a specific theoretical perspective tend to focus only on their approach as the definitive understanding of the learning process. However, the study of learning is so complex that it benefits from having multiple perspectives and explanations, whether they are structured as theories, models or generalizations.

**Findings from Neuroscience**

Cognitive neuroscience is the study of how the brain thinks. In the last 20 years, the advances in neuro-imaging techniques such as MRI and fMRI have allowed neuroscientists, biologists and doctors to examine the brain in action as never before. Researchers can now watch which parts of the brain activate when people (and sometimes animals) perform specific functions or react to particular stimuli. Often studies are performed on people who have had a brain injury or malformation; under these circumstances, neuroscientists can observe what happens when certain parts of the brain cannot be activated (Byrnes, 2001). The resulting findings have been fascinating to practitioners in many fields, including education. Despite the interest in the discoveries, not everyone in education agrees with the interpretation of the findings, or their application to the fields of psychology or education.

The focus of this Literature Review is to provide an overview of the published interpretations of cognitive neuroscientific research and the resulting applications developed for use in the education of adults. It is not within the scope of this thesis to evaluate the accuracy of the research or its interpretation. In addition, this thesis will not attempt to provide background information on the biology of the learning process, such as which parts of the brain activate
when learning occurs. When biological processes are described, they will be in the context of how the interpreters and educators have interpreted the learning process.

Criteria for literature selection – Interpretation of neuroscience.

As discussed earlier, there is debate in the literature as to what elements in neuroscientific findings are applicable to education. In order to select which elements to consider, the literature reviewed came out of a variety of fields including education, psychology and neuroscience. The criteria for selection included authors from each field who were 1) widely cited, 2) active interpreters of neurological findings as they apply to learning and 3) proponents of the application of brain-friendly findings to adult learning practices. As most of the interpretation and application of the findings are done in the field of education, four of the six listed sources are educators. One psychologist and one biologist have also been included in the literature sampling.

- **Dr. Renata Caine and Geoffrey Caine** – Educators who have focused their research and practice on applying a combination of psychological/educational learning theory and their interpretation of Cognitive Neuroscientific findings to the education of children. In recent years, they have expanded the application of their approach to include adults.

- **Eric Jensen** – Educator who started his work on brain-based learning working with children, but has since expanded the application of his approach to include adults. For years, he held an annual Brain Expo, bringing together brain-based educators from all fields.

- **Dr. Robert Sylwester** – Emeritus Professor of Education at the University of Oregon who has written extensively about the role of neuroscience in education.
• **Dave Meier** – Director and Founder of the Center for Accelerated Learning. His program is based on psychological and neuroscientific findings and is used in his work with businesses and organizations.

• **Dr. James Byrnes** – Psychologist and Associate Dean of Psychological Studies in Education at Temple University.

• **Dr. James Zull** – Professor of Biology at Case Western Reserve University who has written extensively on the applications of Neuroscience to Education. He is the Founding Director Emeritus of the University Center of Innovation in Teaching and Education at Case.

**Neuroscientific findings applicable to adult learning.**

This section explores the neuroscientific findings each author/interpreter identified as relevant to the education of adults. After reviewing the literature, seven elements were selected because they were most frequently identified as influencing learning: brain plasticity, emotion, attention, threats and stress, memory, meaning making, and the body.

**Brain plasticity.**

One of the most exciting discoveries in neuroscience is the realization that the brain has the ability to change and grow as a result of new experiences and new learning. This finding opens up opportunities to change ingrained skills and behavior. Whenever a person experiences something new, the body processes it on a chemical and electrical level, which in turn creates changes on a biological level. At that point, physical connections are made between neurons in the brain: The greater the number of connections between neurons, the deeper the learning (Jensen, 1998). When someone needs to change prior learning, these connections literally have
to be re-established. The brain’s ability to grow and develop continues throughout our lifetime (Sylwester, 2004).

**Emotion.**

Other neuroscientific findings describe the fundamental role that emotion plays in how we take in, process and store what we experience. Research has confirmed that emotions are interconnected with thought in a physical way on the most basic level (Zull, 2003; Meier, 2000), chemically and biologically, to the point that the “chemicals of emotions are released virtually simultaneously with cognition” (Jensen, 1998, p.93 citing the work of Hobson, 1994 and LeDoux, 1996). Emotions shape how people learn concepts (Caine & Caine, 1991), they influence what a person experiences as “reality” (Pert, 1997, p. 147) and help determine what one will remember or forget. People cannot have a thought, experience an event, or recall a memory without it being linked to an emotion. Zull calls emotion, “the foundation of learning” (2006, p. 7).

Brain research has also dispelled the myth that rational thought must be devoid of emotion. Based on studies of individuals who had experienced damage to emotion centers in the brain, Damasio found that “emotion is integral to the processes of reasoning and decision making” (1999, p. 41) “especially when it comes to personal and social matters involving risk and conflict” (p. 42). “We must cease the long-standing habit of thinking of emotions as always irrational or having nothing to do with the ways we think. Emotions are a critical source of information for learning” (Jensen, 1998, p. 78 citing the work of LeDoux, 1993).

In *Brain-Based Learning: The New Paradigm of Teaching* (2008c) Jensen outlines five ways in which emotions influence learning (p. 90):

- To bind the learning
• To help us determine what’s real, what we believe and feel
• To activate long-term memory on an intense and widespread chemical basis
• To help us make faster decisions by using non-conscious and gut-level judgment
• To help us make better-quality decisions by engaging our values.

**Attention.**

Related to emotions is the concept of attention – Where we put our focus. The psychological and neuroscientific understanding of attention are consistent (Byrnes, 2001): a person unconsciously scans their environment and notices a variety of details. The stimulus that evokes the strongest emotional response, given the person’s current physical and emotional state, becomes the focus of attention. The process occurs on a physical level (Zull, 2002), with emotions changing the chemical production in the body, and attention motivating any resulting behaviors and decisions (Sylwester, 2006). Research has also shown that attention can be controlled (Byrnes, 2001) and can be influenced by priming (Jensen, 1998; Byrnes, 2001) and strong contrasts (Jensen, 1998). Zull (2006) believes we have evolved this way; Jensen is more specific and claims that the purpose of attention is to “1) promote survival and 2) extend pleasurable states” (1998, p. 42).

**Threats and stress.**

The neuroscientific research shows that stress is highly subjective – What can seem extremely stressful to one person may have no impact on another (Byrnes, 2001; Jensen, 1998). A low level of stress (tension) can actually increase alertness, memory and attention (Zull, 2006, 2002; Caine & Caine, 1994), while extreme or prolonged stress can create long-term and even permanent damage to memory, impede the creation of new memories, as well as be detrimental to immune systems and cognitive functioning (Jensen, 1998; Caine & Caine, 1994). Two
factors help determine whether a stimulus will be perceived as threat: 1) the level of control that a person has over the threat and 2) the individual’s assessment of the resources available to them to help them deal with the situation (Byrnes, 2002; Jensen, 1998; Caine & Caine, 1994).

Memory.

“Human memory is multifaceted and widely distributed across many regions of the brain” (Byrnes, 2001, p. 71). To date it has been shown that short and long-term memories are distinct from each other and yet interconnected (Jensen, 1998; Byrnes, 2001; Zull, 2002; Meier, 2000). In addition, there is support for separate functions for explicit (consciously known facts, stories and events) and implicit (unconscious knowledge such as physical skills, habits as well as conditioned and emotional responses) memories (Jensen, 1998; Byrnes, 2001; Zull, 2002; Meier, 2000). The ability to recall, reconstruct and reflect on previously learned information is critical to the role of memory in learning (Jensen, 1998; Byrnes, 2001; Zull, 2002; Meier, 2000). In fact, “studies show that 70% of what you learn today can be forgotten in twenty-four hours if you do not make a special effort to remember it” (Rose & Nicholl, 1997, p. 131). Certain elements of memory are critical to the learning process:

- "Memory is modified each time it is remembered" (Cozolino, 2002, p. 103).
- Memory can be altered by new experiences.
- Memory can alter our current experience.
- New memories are a combination of new external experience and new internal experiences as well as old internal/external experiences.

It should also be noted that the brain has a much greater capacity for remembering and recalling images than words (Zull, 2002; Meier, 2000).
Caine and Caine (1994) focus on specific portions of memory that they name Locale and Taxon. Locale memories exist within a context that can include sensory experiences and connections to other events and places such as memories of vacations or movies. Taxon memories (e.g. phone numbers, driving a car, military training) are learned by rote. These two memory systems work independently and interactively to generate meaning.

Memories are embedded within the context in which they occur. A memory can be triggered by a sight, smell, feel, taste, or touch that is associated with it. Jensen interprets the importance of context to learning in this way:

This may explain why the physical, concrete learning that happens when students act out new material better prepares them for real life. Pilots use simulators for training, the military creates mock war situations, and theater groups do rehearsals. In formalized learning situations, increased real-life simulation can also increase the applications of the learning. And of course, this strategy is most productive when physiological and mental states are matched as closely as possible between practice and reality. (Jensen, 2008c, p. 160)

**Meaning making.**

The brain constantly takes in data through the body’s senses. The information has no meaning in and of itself. In fact, different people given the same concrete facts could create different meanings for themselves (Zull, 2002). Once the brain receives the data, it creates meaningful patterns through connections made with earlier experiences (Zull, 2006). The greater our level of past experiences, maturity and/or the more we reflect on new learning, the deeper the meanings that can be created (Zull, 2006; Jensen, 1998). Some researchers say that the brain’s ability to make patterns is innate (Jensen, 1998; Caine & Caine, 1994) and that it occurs on a
micro-neuronal, level (Jensen, 1998). Sylwester (2000) and Jensen (1998) also interpret the research to show that many systems in the brain assist in the creation of meaning.

**The body.**

Neuroscientific researchers make many associations between the body and learning: The mind and body are connected on many levels; learning changes the body on a physical level (see Brain plasticity, p. 35); emotion is experienced on a physical level; information is received through the senses; and movement enhances learning.

Interpreters of neuroscientific findings see the brain and body as highly interconnected. Jensen (1998) quotes neurosurgeon Dr. Richard Bergland who explains that “thought is not caged in the brain, but is scattered all over the body” (p. 77). In addition, Jensen states that research has shown that physical movement and learning are processed in the same part of the brain (1998). Sylwester concludes that the only reason animals have a brain is because our bodies move, creating an indelible mind-body connection between learning (food sources, dangerous situation), sensory input, movement and survival:

> If an organism has legs, wings or fins, it needs a sensory system to inform it about here and there, a decision system to determine whether here is better than there or there is better than here, and a motor system to get it to there. (Sylwester, 2006, p. 32)

Zull (2003, p. 1) tells us that “emotion and thought are physically entangled,” and that “our brain is always influenced by how our body is feeling.” As a result, changes to our physical state can create changes in our emotional state (if the room is too hot, you might get cranky; if you take a few deep breaths, you can calm down) and vice versa (if you are nervous, you might sweat; if you are happy, you might smile). He also believes that there is a direct connection
between forward movement, or even the anticipation of forward movement, and pleasure (Zull, 2002, p. 62) – This is why we like a good mystery or get a thrill from trying to attain a goal. “To the brain, movement is more than physical movement of parts of the body; it is also mental movement or imagined progress” (p. 234).

Movement also has close ties to learning in other ways. We constantly communicate ideas and feelings to each other through facial expressions, gestures, speech and writing, all forms of physical movement (Zull, 2002). Through movement and physical interaction with the outside world, we test out assumptions and ideas. Jensen makes the following interpretation:

All motor activity is not purely mechanical; it’s preceded by quick thought processes that set goals, analyze variables, predict outcomes, and execute movements. Pulling this off requires widespread connections to all sensory areas.

(Jensen, 2008c, p. 16)

While learning, the body processes information from the surrounding environment through all its senses, consciously and unconsciously. Sight seems to play a greater role (Zull, 2006). According to Jensen’s review of neuroscientific work, the best way to convey information is through concrete vivid images because,

- The brain has an attentional bias for high contrast and novelty;
- 90 percent of the brain’s sensory input is from visual sources; and
- The brain has an immediate primitive response to symbols, icons and other simple images. (Jensen, 2008c, p. 56)

Neuroscientific findings also link observation to learning through the mirror neuron system. Research using fMRIs show that the same portion of the brain activates whether a person does an activity or watches someone do that activity. This finding has been interpreted
by some to mean that “the brain is wired to copy what we observe” (Zull, 2006, p. 195) and that, “everyone is designed to imitate and model others” (Caine, Caine, McClintic & Klimek, 2005, p. 51).

**Summary of neuroscientific findings related to learning.**

After reviewing the literature, this researcher selected the seven elements consistently identified by interpreters of brain research as integral parts of the learning process: Brain plasticity, emotion, attention, threats and stress, memory, meaning making, and the body. The findings indicate that the learning process occurs on multiple levels simultaneously – Physical, emotional, and intellectual. Input into the learning process can come externally from the learner’s environment and internally from their memories, feelings or physical state. In addition, the way in which information is received and later remembered is greatly influenced by the context in which it was presented.

One of the revelations that came out of neuroscientific research was that the brain could continue to learn and relearn throughout its lifetime. In addition, findings confirmed that emotions, thought and actions are integrated on a physical level.

**Practices Developed to Address the Interpretations of Neuroscientific Findings**

The neuroscientific discoveries described above led to interpretations of their application toward education and resulted in the development of practices for the classroom. This section will provide a brief overview of these practices as they relate to brain plasticity, emotion, attention, threats & stress, memory, meaning making and the body.

**Criteria for literature selection – Brain-friendly classroom practices.**

In order to get different perspectives on the brain-friendly applications recommended by educators, we surveyed the literature from two methodologies: Brain-based educators (Caine,
Caine, McClintic & Klimek, 2005; Jensen 1998 and 2008c; Allen, 2002 and 2008) and Accelerated Learning educators (Meier, 2000; Rose, 1997). The examples below are not comprehensive and educators may utilize practices that are not specifically identified in their writings.

**Brain plasticity.**

The brain can learn new things at any age as a result of being exposed to new experiences. In order to take advantage of this process, practices are designed to both establish new neural networks by integrating new knowledge, and make the networks more complex by creating more connections with the material in a variety of ways. Examples of practices include: providing inquiry-based instruction; going through the process of problem solving even if you get the wrong answer; implementing self-directed learning to find the right level of challenge (Jensen); relating materials to real-life situations, solving complex problems (Rose, Meier, Jensen); giving feedback that is immediate and specific (Jensen), positive and constructive (Rose); combining challenge and novelty, changing the way things are presented and how fast (Jensen); incorporating the arts, puzzles, word games, hypotheticals (Jensen, Rose); creating maps (Rose); and doing exercises to help recall the information learned (Meier).

**Emotion.**

Emotion is fundamental to learning – It affects how we perceive, how we think and even how we remember. A review of the literature showed that practices designed to address the emotional aspects of learning generally fall into one of four categories: environment, trust, process and the role of the teacher:

- **Environment** – The learning experience is pleasant, enjoyable (Caine), fun (Jensen, Meier), relaxing (Allen), and non-threatening (Jensen, Caine). The
educator’s philosophy values learning and encourages risk taking (Rose), and values the learner (Jensen). Strong emotions should not be stimulated in settings where it is not appropriate (Rose, Allen).

- **Process** – Establish common ground-rules (Jensen, Rose, Allen) so everyone understands how to best work with each other. Create activities that help encourage joy (Caine, Meier), enthusiasm and awe (Caine); don’t create emotional situations randomly or illicit extreme emotional responses (Jensen). Engage emotions right after a learning experience (Jensen). Acknowledge and celebrate student accomplishments (Jensen, Meier). Explain each exercise before you do it and debrief after (Allen), provide people with the option not to do an exercise they feel uncomfortable (Allen), include novelty that is relevant, social and fun (Jensen); encourage self reflection (Jensen), involve students in decisions about how things will be done (Caine); let people know what is coming to build curiosity, suspense, and anticipation (Allen), have learner reflect on feelings (Jensen)

- **Trust** – Support safe expression of difficult issues (Jensen); encourage collaboration and sharing (Jensen, Meier); build positive and trusting emotions (Meier), create connectedness through games and activities (Meier), promote inclusivity (Allen), establish trust before dealing with emotional issues (Allen), don’t put people on the spot (Allen)

- **Teacher** – Work with emotions as they come up in the room (Caine), practice conflict resolution when needed (Caine), develop self-awareness about their own emotions and the impact of those emotions on the group (Caine), model how to
work with uncomfortable emotional situations (Allen), model a love of learning and enthusiasm (Jensen) have a support group of other teachers (Jensen)

**Attention.**

Keeping a learner’s attention has to do with engaging them with the material while maintaining a physical and emotional state conducive to learning. Many of the practices are about keeping the material relevant and meaningful to the student. Other practices are designed to keep the student engaged through novelty, challenge and energetic activities.

- **Relevance** – Give students choices about how they will learn and how (Jensen, Caine, Rose); make connections with their real-life situation (Jensen, Caine, Rose); have them make presentations (Jensen); help them be aware of what they pay attention to (Caine); make connections to feelings and reactions (Caine); encourage self-questioning (Caine, Rose); stimulate debate (Rose); find how the material makes sense (Rose); create learning maps (Rose); look for meaning in a variety of ways (Rose)

- **Engagement** – Set deadlines (Jensen, Allen); open with energizing rituals (Jensen); don’t let the teacher become the entertainer (Jensen); change tone, change location, change pace, and change times for reflection (Jensen); use music (Jensen, Allen, Meier); employ kinesthetic exercises (Jensen); use props (Caine); don’t overwhelm (Caine, Allen); present things in patterns (Caine); incorporate novelty (Jensen, Caine); incorporate breaks (Allen, Rose); move around the room (Jensen, Allen)
Threats and stress.

Successful learning involves having the right level of stress – Too little and people can get bored, too much and people will stop learning. Most practices in the literature create environments that are low on stress, as well as methods to reduce or release stress when it occurs. There are also practices designed to stimulate learning and create challenge.

- **Setting the environment** – Establish conflict resolution practices (Jensen); keep the room safe from violence and not too crowded (Jensen); practice neutrality (Caine); play soft music (Caine); create quiet areas in the room (Caine); focus on positive expression (Meier, Allen); manage negative talk (Jensen); teach learners about stress and how to release it (Jensen, Caine); take breaks from intellectual work (Allen); use precise language (Allen); set clear expectations (Allen, Rose); role model acceptable behavior (Allen)

- **Controlling stress** – Asking people to take a deep breath (Jensen); guide visualizations (Jensen, Caine); request regular feedback on progress (Jensen); work together (Jensen); promote reflective journal writing (Jensen); create downtime (Jensen, Caine); avoid helplessness (Caine); move people around (Caine); be aware of the state of the room (Caine); try “ordered sharing” (Caine, p. 41)

- **Creating challenge** – Encourage lively discussion (Jensen); play games (Jensen); celebrate accomplishments (Allen); build anticipation (Allen); collaborate rather than compete (Caine)

Memory.

There are many levels to working with memory. First, there needs to be understanding, then learning, and finally the ability to recall the information learned. None of these can happen
without attention, which incorporates both emotional connection and physical state. As memory is tied to emotion and attention, many of the practices already listed above are useful to the processes that involve memory.

- **Understanding** – Involve learners in the learning process (Allen); pause after each visual and don’t speak (Allen); incorporate hands-on learning (Jensen); associate learning with what is already known (Rose); review during and after the presentation of the material (Rose); navigate information, don’t memorize it (Meier); analyze past experiences (Meier); observe, reflect and debrief (Allen, Meier)

- **Emotional connections** – Tell stories (Allen, Caine, Jensen; Rose); link information to images (Allen); build curiosity and suspense about the material (Allen, Jensen); vary the type of visuals used (Allen); use music to create connections to the subject matter (Jensen); tie learning to specific locations (Jensen); bring in the unusual (Rose); learn in groups (Jensen, Caine, Allen, Meier, Rose)

- **Recall** – Use mnemonics, acronyms, and peg words (Allen, Jensen, Meier); incorporate rhymes and songs (Jensen, Caine, Meier); visualize answers (Jensen, Caine); repeat key ideas regularly (Jensen); implement peer-teaching (Jensen); match learning and recall states (Jensen); demonstrate learning through role play or re-enactment (Jensen, Meier, Caine, Rose); play games that are active (Rose) or based on quiz shows (Caine); organize the material (Rose, Meier); reorganize the material (Jensen, Meier); decide to remember (Rose); tie learning to music (Allen, Jensen); link content to strong images (Jensen) or stories (Meier)
Meaning making.

A core element of understanding is meaning making. Each person creates their own meaning for each piece of new knowledge. A critical element of this process is the context in which the new information is presented, as well the connections the student makes between the new information and their current understanding of how things work.

- **Context** – Explore the material and why it is important (Allen, Caine; Meier); paint a mental picture of the information (Allen); create bridges between topics (Allen); use visual representations of the material (Allen, Caine); cooperate during the learning process (Meier); teach different content in different areas in the room (Allen);

- **Relevance** – Let learners discover the relevance of the material to them (Jensen, Caine), discuss to explore personal connections (Jensen, Caine), share common experiences (Jensen, Caine); make connections to current beliefs (Caine)

- **Understanding** – Show the material, wait for people to absorb it, ask questions to assess understanding, explain when needed (Allen); use clarifying examples and explain unfamiliar terms (Allen); role play (Allen, Rose); map learning (Jensen, Meier); journaling (Jensen); let learners explain the material to each other (Jensen); apply new material to current situations (Meier); let learners simplify the material (Meier); explore the implications of the new learning (Meier); create key words labels (Meier); do then draw (Meier, Allen, Jensen)

The body.

The body is involved in all aspects of learning. The practices coming out of neuroscience consider environment, processing, emotions, and physical needs.
• *Environment* – Create an environment where the learner can be immersed in content (Allen, Jensen, Caine; Meier; Rose); encourage learning by doing (Caine, Meier, Rose); decorate the room (Allen, Meier) including plants (Caine); create working models (Jensen, Meier; Rose); have posters on the walls (Allen, Jensen); put up work done by learners (Jensen); create a safe and comfortable environment (Jensen); give learners control over the set up of the environment (Jensen, Caine); create places for learners to be together or alone (Caine)

• *Processing* – Consider of the impact of the teacher’s actions (Allen); teach different content in different locations (Allen, Meier); involve all the senses in providing information (Allen, Meier); vary the type of input and the media used (Allen, Caine, Meier); move to music/rhythm (Caine, Meier, Rose); use concrete images or objects (Meier, Jensen, Caine); express ideas in small and large formats (Meier, Rose); read out loud (Meier, Rose); talk and listen (Meier); use visualizations for learning (Jensen, Meier, Rose); write things out (Jensen, Rose, Meier); learn in groups (Jensen, Allen, Rose, Meier, Caine); check off what has been learned (Rose); role-play (Rose); create graphic representations of concepts (Rose, Jensen); create puzzles (Rose); use related objects to help teach the material (Jensen, Caine, Meier)

• *Emotions* – Use physical activities to help reduce stress (Allen, Jensen) and/or energize (Jensen); use visualizations for relaxation (Jensen); create metaphors (Meier)

• *Physical needs* – Keep students hydrated and fed (Jensen); incorporate rituals that include actions such as high-fives, greetings, and clapping (Jensen); consider
lighting and room temperature (Jensen); enable each learner to be responsible for taking care of their needs (Jensen); have room for people to spread out (Caine); have learners move around (Meier, Rose, Caine); alternate between physical and sedentary activities (Meier); break every 30 minutes (Rose, p. 143); have learners make noises (Rose, Meier, Jensen, Caine, Allen)

Summary of practices developed to address the interpretations of neuroscientific findings.

Brain-based and Accelerated Learning methodologies promote slightly different structures for the learning process. Due to their shared focus on the learner and the importance of the body’s role in learning, however, the actual practices used with learners are very similar.

Where the methodologies most differed was in the areas relating to emotions, as well as attention and stress, also closely tied to emotions. Although both methodologies agreed on a conceptual level and did give some similar practices, Brain-based educators offered a greater number of concrete examples of classroom practices to address the emotional aspects of learning.

The area that generated the greatest number of specific practices in each methodology was somatic learning – How to integrate the physical aspects of learning into classroom activities.

Research Overlap Between Cognitive Neuroscience and Cognitive Psychology.

Byrnes (2001) makes the following determinations about the level overlap between psychological research and brain research when it comes to each of the first five neuroscientific findings identified above:

- *Brain Plasticity* – Both psychological and neuroscientific research on plasticity builds on each other.
• **Emotion** – Byrnes expresses his disappointment that neuroscientific research has not used existing psychological models on emotion (appraisal, conscious vs. unconscious emotions, distinctions between emotions) as a starting point. Instead, most brain studies have focused on specific emotions (anger or fear) and how they are processed neutrally.

• **Attention** – The overlap between neuroscience and psychology in the study of attention is substantial and each field regularly uses the terminology and findings from the other in their research. However, Byrnes suggests that there is “still much to learn” (p. 88) especially when it comes to finding direct connections that can help with attention in the classroom.

• **Threats & Stress** – Unlike the more general field of emotion, the neuroscientific and psychological studies of stress and fear have had more overlap.

• **Memory** – Neuroscientific research has been able to identify some of the regions of the brain where memory occurs. Other research has been done to test out psychological theories on memory. Byrnes concludes, “The psychological and neuroscientific perspectives on memory seem to be largely consistent with each other” (p. 71).

Byrnes’ findings show that the fields of psychology and neuroscience have found many ways to build on each other’s findings. In addition, James Zull indicates that neuroscientific research supports the process described by the Experiential Learning cycle, “the learning cycle arises from the structure of the brain” (2002, p. 18).

Jensen also recommends that the two fields have much to offer each other:
As an author in the brain-based movement, I have reminded educators that they should never say, "Brain research proves . . ." because it does not prove anything. It may, however, suggest or strengthen the value of a particular pathway. What educators should say is, "These studies suggest that XYZ may be true about the brain. Given that insight, it probably makes sense for us, under these conditions, to use the following strategies in schools." This approach, which is a cautionary one, sticks with the truth. When one is careful about making causal claims, the connections are there for those with an open mind. (Jensen, 2008a, Conclusion)

This back and forth between the two fields can only serve to enrich the information on learning by creating greater opportunities for educators to understand how adults learn and how to best support that learning. In addition, the different perspectives held by the education, psychology and neuroscience could help guide each other regarding future areas of research.

**Summary of the Literature Review**

Given the vastness of the literature available on both adult learning theories and cognitive neuroscientific research, the Literature Review section attempted to avoid the “folly” (Weimer, 2002, p. 6) of trying to condense and organize the material by establishing preliminary criteria for the information to be included.

- Adult learning theories were included in order to provide a context for understanding the application of neuroscientific findings
- Only interpretations of neuroscientific findings that had been identified as relevant to adult learning were considered
- The validity of the underlying research and the interpretations were not examined.
Adult Learning Theories.

Based on the work of Merriam, Caffarrella & Baumgartner (2007), eight theories were selected for review: behaviorist, humanist, cognitivist, social cognitive, constructivist, andragogy, transformational learning, and experiential learning. These theories were compared along five major issues: The purpose of learning; the learning process, the learning environment; content; and classroom practices.

This review, although not comprehensive, established a starting point for understanding the theories on adult learning derived from observation and extrapolation of student behavior, and fine-tuned by years of application and implementation. Each theory provided a different perspective on and approach to adult learning. However, educational psychologists Ormrod (2004) and Gagne (1965) indicated that perhaps a complete understanding of adult learning needed a broader perspective than that which could be provided by any one theory.

Neuroscience.

The review provided an overview of the published interpretations of cognitive neuroscientific research and the resulting applications developed for use in the education of adults. Based on the interpretations of four educators, one biologist, and one psychologist, seven key areas of neuroscientific findings were identified as integral to adult learning: brain plasticity, emotion, attention, threats and stress, memory, meaning making, and the body. The consensus was that the learning process occurs simultaneously on a physical, emotional, and intellectual level. As such, each of these must be considered in the development of a learning process. Other points of agreement were that neuroscientific findings did not provide any proof of the validity of brain-friendly practices and that people could learn and unlearn throughout their lives.
Next steps.

Having created a background of theory and interpretation in the Literature Review, the Results portion of the study will explore how educators currently integrate interpretations of neuroscientific findings into their work with adult students. Later, the Discussion section will compare and contrast the approaches recommended by the various adult learning theories and cognitive neuroscience interpreters, and adopted by educators of adults.
Research Methodology

Research Method Overview

The purpose of this study is to consider the influence of cognitive neuroscientific findings on the way educators of adults think about their work, approach the development of curriculum and interact with their students. Exploring the way in which educators perceive the learning process and approach teaching required an examination of the subjective experience of the participants. The researcher chose grounded theory, a qualitative method of research (Creswell, 1998), as the most appropriate method because it reflected, “A commitment to understanding the ways in which reality is socially constructed” (Richards & Morse, 2007, p. 59). The methodology is flexible enough to allow each educator’s reality to be shared individually while allowing categories, similarities and differences to emerge from an analysis of the information from each sample of educators (Creswell).

Sample and Sample Selection

The sample of participators consisted of six educators of adults from various areas in the United States. Criterion for each participant was a minimum of two years of experience incorporating methodologies based on the neuroscience of learning into their work with adult students. The researcher identified potential participants during the Learning Brain Expo held in January 2009 in Newport Beach California and then recruited them by e-mail or telephone after the conference (See Appendix A). Additional participants were identified through the researcher’s contacts at JFK University, and recruited by e-mail or telephone (See Appendix A). Various organizations that promote Accelerated Learning or Brain-based practices were contacted as potential sources of participants. However, no organization responded to the requests. Individuals who were interested in participating were asked to respond by e-mail or
telephone and were subsequently telephoned by the researcher. At that time, participants were told more about the study and interviewed briefly to see if they fulfilled the criteria to participate in the study. Those who fit the criteria for the study were placed on the selection list and notified via e-mail or telephone. Those that did not meet the criteria were advised accordingly and thanked for their consideration.

Data Collection

The qualitative research design consisted of a preliminary survey (See Appendix C) and a formal semi-structured interview (See Appendix D). Once selected and once they gave their consent, participants were sent a preliminary survey to ascertain their level of familiarity with both adult learning theory and brain research on learning.

After the survey was returned, the researcher held a formal semi-structured interview, in which participants were asked pre-defined questions regarding their first-hand experience teaching adults using practices based on neuroscientific findings.

Preliminary survey.

The purpose of the preliminary survey was to obtain each participant’s self-assessment on a variety of teaching related topics such as, their experience with both adult learning theory and brain-friendly interpretations, their preferred sources of information and the level to which they interpreted research findings. The researcher believed that it would be helpful to have this background information prior to the interview. The preliminary survey was made available to each participant as an e-mail attachment or by mail and completed without the researcher being present. Responses were returned to the researcher by either e-mail or regular mail. The researcher compiled the answers.
Preliminary survey questions.

The survey combined three types of questions: numerical rating scales, phase completion scales and open ended questions. On numerical rating scales, participants assigned a number to indicate the degree to which a given statement was valid for them (Kerlinger & Lee, 2000). Phrase completion scales were utilized because they were identified by Hodges & Gillespie (2003) to be more effective than Likert scales; here participants assessed where they fit along a continuum range of responses to a given personal statement. Lastly, open-ended questions encouraged participants to share their point of view on the given topic. The survey contained sections dealing with the following issues (for the full survey, see Appendix C):

SQ1 – Experience working with adults
SQ2 – Factors that influence work with adults
SQ3 – Knowledge of psychological theories of adult learning
SQ4 – Incorporation of adult-learning theory
SQ5 – Influential element(s) of adult learning theory
SQ6 – Knowledge of learning-related brain research
SQ7 – Incorporation of learning-related brain research
SQ8 – Influential element(s) of learning-related brain research
SQ9 - Implementation vs. Interpretation of neuroscientific research

Preliminary survey site.

The site for this study was a location suitable for the participant, possibly their office or home. There was no interaction with the researcher while the participant filled in the survey, unless questions were left blank. The researcher addressed any unanswered question during the
Interview to determine whether the omission was deliberate or whether the participant wanted to provide an answer to the question.

**Interview.**

Once their Preliminary Survey had been received, participants were interviewed individually. In the interviews, the participants were asked to describe how knowledge of the neuroscience of learning influenced their work as educators of adults. The research was open to all possibilities in order to discover the participant’s perspective of adult learning.

Each interview was recorded in its entirety, with the permission of the participant, and transcribed by third party transcribers. Each participant was interviewed once, although the possibility of a follow up phone call for clarification or expansion of a thought or view expressed by the participant was introduced at the end of the interview. Field notes were recorded at the end of each interview.

**Interview Questions.**

All the major questions were open-ended and were asked in a non-leading, neutral manner that allowed the participants to express themselves in their own words. Clarifying and follow up questions were asked as needed and may not have been open-ended.

The interviews were divided into seven sections (see below) and each participant was asked the same set of questions (For the full interview, see Appendix D):

- Think about a successful training that you led in which you used your knowledge about how the brain learns. Tell me a little about the training.
- I would like to address the elements that you integrated into the development or editing of the training curriculum that you specifically included because of how you think the brain learns best.
I would like to address what you saw as your role when you led the training.

I would like to address your interaction with the students during the training.

I would like to address what you pay attention to when you are leading a training.

I would like to address what your personal connection to working with neuroscientific findings in your work.

Is there anything else you want to share with me about integrating brain research into the way you approach your trainings / workshops?

Within each section were primary questions and follow-up questions asked for clarification on specific underlying issues. When necessary, the interview was modified as it was delivered to fit the participant’s unique experiences.

**Interview site.**

Because of the geographic distance between the researcher and the participants, interviews were conducted by telephone, with the participant and the researcher in their respective offices or homes.

**Data Analysis**

This was an exploratory study. The researcher reviewed the data from interview transcriptions and field notes, developed codes, and defined emerging themes and relevant categories. Data was categorized and coded. Interviews were transcribed and field notes maintained. The researcher paid particular attention to patterns that developed and applied additional codes and categories accordingly, if applicable.

After the first three interviews were conducted, they were analyzed to discover whether questions should be revised or if additional questions were necessary to improve the data for the remaining three interviewees. As a result of this process, a question was added to the interview.
Each interview was analyzed separately. Upon completion of all six interviews, the data were cross-analyzed. Similarities and differences were noted. Patterns were coded (using open coding) to identify common themes. Each of the participants was described, and quotes taken from their interviews were applied to illustrate common themes and responses.

**Participant introduction to project/invitation to participate.**

Participants were selected from the list of interested individuals who met the criteria during the confirmation process. Participants were invited to participate in the proposed study via e-mail invitation:

1. After identifying the potential list of participants, an individual e-mail was sent to each potential participant (See Appendix A). Candidates were invited to respond to the researcher directly, via e-mail or telephone, if they choose to participate.

2. Participants who responded affirmatively to the invitation to participate were contacted by the researcher directly, via phone or e-mail, to confirm that they meet the criteria for participants, and to schedule an interview date, and time. As all interviews were held by telephone, the researcher confirmed the preferred phone number where the participant can be reached.

**Informed consent.**

Human participants were protected in accordance with the ethical standards taken from the APA Code of Conduct (2003). Prior to the scheduled date of the interview, a consent form (See Appendix B) emphasizing confidentiality was forwarded to the participant for their review, and was discussed in detail. The consent form included a clause explaining that participation in the study was voluntary and that participants were free to change their mind at any time, even
after signing and submitting the consent form. The form confirmed that the information provided during participation in the study would be confidential and anonymous.

Participants interviewed by phone were asked to sign and submit the consent form, via confidential fax or U.S. mail, prior to the scheduled date of the interview. The researcher verified that the participant understood the documents and the process. Participants were given time to read and sign the consent forms. The researcher assigned participant numbers to each participant to insure confidentiality and anonymity. All coded notes and participant identifications remained confidential.

Data were stored in a secured, confidential location, accessible only by the researcher and a third-party transcriber. All data and notes were kept in a locked cabinet in the researcher’s home office for the duration of the research process. All tapes of interviews will be destroyed upon completion of the final paper.

Debriefing procedures.

At the conclusion of the study, individual participants were given the opportunity to debrief with the researcher. Each participant was given time at the end of their interview session to ask questions or express any concerns they may have. The researcher responded to their questions and concerns at that time. If, at any time after the interview, session participants wished to address any outstanding issues or questions regarding the interview or final report, they were invited to call or e-mail the researcher directly to schedule a follow up session. A summary of findings were made available to them, upon request.

Participants were invited to contact the JFK University Project Advisor if they had questions or requests for additional information regarding this study and the interview process:

Sharon Mulgrew, M.P.H. – Organizational Psychology Research Coordinator
Researcher Bias

I am an educator of adults fascinated by the developments in adult learning inspired by neuroscience. I began to wonder how these new findings influence educators working with adult learners. How has the research been interpreted? Have there been successful applications? Are the findings and applications meaningfully different from what other educators have developed from working with adult learning theory and from their trial and error of experience in the classroom? I decided that the first steps were to compare the findings from both fields and to explore the subjective experience of those who have already incorporated neuroscientific findings and practices into their work with adults. I recognize that it is in my best interest to remain neutral in order to learn more from other perspectives and I will remain open to all data as it is presented. Due to the criteria of the research method, bias awareness is particularly important, and an awareness of that bias will be maintained by the researcher, me.

Limitations

The findings of this study will be tentative. The sample size and procedures for participant selection are appropriate for qualitative research. Due to the small scope of the study, however, they may not support generalization to a larger population of educators.
Results

The purpose of this study is to explore how neuroscientific findings regarding learning influence the work of those who teach adults. The study examines the first hand experience of six educators who describe themselves as incorporating neuroscientific findings into their work with adult learners. Interview questions explore factors such as curriculum development and content, presentation of material, role of the educator, interaction with students, and preparation.

<table>
<thead>
<tr>
<th>Participants</th>
<th>Gender</th>
<th>Primary work</th>
<th>Years influenced by brain-based research</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>Male</td>
<td>Teacher educator</td>
<td>10</td>
</tr>
<tr>
<td>P2</td>
<td>Female</td>
<td>Teacher educator</td>
<td>20</td>
</tr>
<tr>
<td>P3</td>
<td>Female</td>
<td>Corporate trainer</td>
<td>25</td>
</tr>
<tr>
<td>P4</td>
<td>Female</td>
<td>Corporate facilitator</td>
<td>11</td>
</tr>
<tr>
<td>P5</td>
<td>Male</td>
<td>University instructor</td>
<td>5</td>
</tr>
<tr>
<td>P6</td>
<td>Female</td>
<td>University instructor</td>
<td>10</td>
</tr>
</tbody>
</table>

The questions also explore different ways and degrees to which educators interpret brain research and translate it into classroom practices. The results come from two sources:

1. One-on-one interviews with six educators who have utilized brain-based methodologies in teaching adults for at least 2 years (See Table 5).
2. Surveys of the educators to determine their level of experience and preferred resources, as well as the extent to which they interpret and apply research findings.

The results of the interviews and surveys are discussed in the Survey Results and Interview Results sections below.
Definitions

To avoid confusion regarding terminology, key terms have been designated to refer to key concepts used throughout the study. This section identifies and describes those key terms.

**Participant** – A person interviewed for this study.

**Educator** – Participants take on a variety of roles when working with students, including teacher, instructor, trainer, coach, facilitator, etc. When referring to the participant’s role in a non-specific manner, this study uses the term “educator.”

**Teach** - Educators may utilize a variety of methods as they help adults learn new information, develop skills or shift perspective. The educator’s approach could be active or passive; direct or indirect; verbal or non-verbal. When referring in a non-specific manner to the educator’s process, this study uses the verb “to teach.”

**Student** – An adult taught by the participants.

**Event** – Adult learning can take place in a variety of forums that range from a two-hour meeting to a multi-day workshop, or even a series of meetings or classes. When referring to forums in a non-specific manner, this study uses the term “event.”

**Classroom** – Events can take place in a variety of venues including a classroom, auditorium, conference room, natural setting, etc. When referring to venues in a non-specific manner, this study uses the term “classroom.”

**Practices** – A participant incorporates a variety of exercises, activities, formats, methodologies and philosophies into the design of an event. When referring to these in a non-specific manner, this study uses the term “practices.”
Brain-Friendly Practices – When referring to practices based on interpretations of cognitive neuroscientific research, regardless of whether they reflect brain-based or accelerated learning methodologies, this study uses the term “brain-friendly practices.”

Somatic – Educators utilize a variety of practices that specifically affect students on a physical level, including gross or small motor activities as well as sensory stimulation. When referring in a non-specific manner to anything that affects students on a physical level, this study uses the term “somatic.”

Survey Results

The purpose of the survey was to obtain background information on participants before the interview. The survey contains four sections:

- Experience in the field
- Factors that impact work as an educator
- Sources and application of knowledge about teaching
- Interpretation of learning-related brain research

Experience in the field.

The first survey question (SQ1) dealt with the years that interviewees had worked as educators and the years they had been using practices based on brain research (Table 6).

<table>
<thead>
<tr>
<th>Table 6 Experience in Working with Adults (SQ1)</th>
<th>Average</th>
<th>Median</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>• How many years you have been teaching adult learners?</td>
<td>17.00</td>
<td>15.00</td>
<td>10.00 – 30.00</td>
</tr>
<tr>
<td>• How many of those years have you been using practices based on brain research?</td>
<td>13.50</td>
<td>10.50</td>
<td>5.00 – 25.00</td>
</tr>
</tbody>
</table>

All of the interviewees fit the criteria of a minimum of two years. All but one of the people interviewed had spent over half of their career as educators using brain based methods.
Factors that impact work as an educator.

The second section of the survey (SQ2) asked the interviewees to rate the factors that influence their work with adults on a Scale of 1-5, with 1 meaning that the factor did not have much of an impact and 5 meaning that the factor had a great impact (Table 7).

<table>
<thead>
<tr>
<th>Table 7 Factors that Impact Work With Adults (SQ2 a-i)</th>
<th>Average</th>
<th>Median</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>• In-classroom observation – seeing how my students interact with the material and presentation</td>
<td>4.83</td>
<td>5.00</td>
<td>4.00 – 5.00</td>
</tr>
<tr>
<td>• In-classroom experience – trying new approaches in the classroom</td>
<td>4.50</td>
<td>5.00</td>
<td>4.00 – 5.00</td>
</tr>
<tr>
<td>• Feedback – evaluations and comments about your trainings from students and other trainers</td>
<td>4.83</td>
<td>5.00</td>
<td>3.00 – 5.00</td>
</tr>
<tr>
<td>• Training publications – reading popular, academic or professional literature on training</td>
<td>2.33</td>
<td>2.50</td>
<td>1.00 – 3.00</td>
</tr>
<tr>
<td>• Psychology or Education literature – reading popular, academic or professional literature on adult learning from the fields of psychology or education</td>
<td>3.50</td>
<td>3.50</td>
<td>3.00 – 4.00</td>
</tr>
<tr>
<td>• Neuroscience literature – reading popular, academic or professional literature on adult learning from the fields of biology or neuroscience</td>
<td>4.17</td>
<td>4.00</td>
<td>3.00 – 5.00</td>
</tr>
<tr>
<td>• Observation – observing other trainers and their techniques</td>
<td>3.83</td>
<td>4.00</td>
<td>2.00 – 5.00</td>
</tr>
<tr>
<td>• Education – attending workshops or conferences that support your work as a trainer</td>
<td>4.00</td>
<td>4.50</td>
<td>1.00 – 5.00</td>
</tr>
</tbody>
</table>

Work in their own classrooms (“In-class Observation, “In-class Experience” and “Feedback”) consistently had the most impact within this group. In addition, 67% and 33% (respectively) of participants listed “In-Classroom Observation” and “Feedback” in the top two.
“Neuroscience Literature” had the most impact of published resources (33%). Participants also rated “Psychology or Education Literature” as important, while “Training Publications” had the least impact of any of the types of literature.

Work in their own classrooms (“In-class Observation, “In-class Experience” and “Feedback”) consistently had the most impact within this group. In addition, 67% and 33% (respectively) of participants listed “In-Classroom Observation” and “Feedback” in the top two. “Neuroscience Literature” had the most impact of published resources (33%). Participants also rated “Psychology or Education Literature” as important, while “Training Publications” had the least impact of any of the types of literature.

“Observation” and “Education” had the greatest range of reported impact among the group, with ratings ranging from 1 to 5. Participants who named “Neuroscience Literature” as one of their top two factors of impact also listed these as the other major source of information.

When asked if there were any additional factors that influenced their work, 67% of the interviewees named meetings and conversation with others involved with the application of brain research, and one listed their work as a K-12 teacher coach.

**Sources and application of knowledge about teaching.**

The third section of the survey identified the participants’ self-assessed level of knowledge and application in the fields of “neuroscience research and application” and “adult learning theory.”

**Adult Learning Theory.**

As described in the Literature Review section (p.8), this body of knowledge represents research and theories regarding adult learning that stem primarily from the fields of psychology and education, and reflect what can be observed and inferred from human and animal behavior
about the way that adults learn. Participants were first asked to indicate the level that appropriately described their knowledge and application of adult learning theory on a range from 0 – 10 (Table 8).

**Table 8 Psychological Theories of Adult Learning (SQ3,4)**

<table>
<thead>
<tr>
<th>Description</th>
<th>Average</th>
<th>Median</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>In describing my level of knowledge of psychological theories of adult learning, I would say (0 = I’m not aware of having any knowledge of adult learning theory; 10 = I’m fully informed on adult learning theory)</td>
<td>7.67</td>
<td>7.50</td>
<td>7.00 – 9.00</td>
</tr>
<tr>
<td>In describing the level to which I incorporate adult-learning theory into my work as a trainer, I would say (0= I don’t knowingly incorporate adult learning theory; 10 = I actively incorporate adult learning theory)</td>
<td>8.67</td>
<td>8.50</td>
<td>7.00 – 10.00</td>
</tr>
</tbody>
</table>

The survey then asked participants (SQ5) to list which elements of adult learning theory most influenced their work. The number in brackets represents the number of times participants listed that response:

- Respect for students and learner motivation (2)
- Making information real, relevant, applicable (2)
- Offering information in variety of methods (2)
- Making learning experiential (2)
- Information processing and movement (1)

These results indicate that the participants have a strong background in adult learning theory and knowingly incorporate it into their work as educators of adults. It is interesting to note that the majority of the responses (7 out of 9) identify the process by which the learner
integrates information (making the learning process real, novel, experiential, and/or somatic).

The other response relates to the educator’s perspective of the learner.

**Learning-related brain research.**

In considering learning-related brain research (Table 9), all of the participants rated their level of knowledge as lower than their level of incorporation of that knowledge.

<table>
<thead>
<tr>
<th>Table 9 Learning-Related Brain Research (SQ6,7)</th>
<th>Average</th>
<th>Median</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>• In describing my level of knowledge of learning-related brain research, I would say (0= I’m not aware of having any knowledge of brain research; 10= I’m fully informed on brain research)</td>
<td>6.67</td>
<td>7.50</td>
<td>3.00 – 9.00</td>
</tr>
<tr>
<td>• In describing the level to which I incorporate learning-related brain research into my work as a trainer, I would say (0= I don’t knowingly incorporate brain research; 10= I actively incorporate brain research)</td>
<td>8.50</td>
<td>9.00</td>
<td>6.00 – 10.00</td>
</tr>
</tbody>
</table>

The participants listed the following four categories of elements of learning-related brain research as those that most influenced their work (SQ8, 9b): Emotion-related factors, brain functioning, socialization, and somatic factors. Unlike adult learning theory, the range of answers was quite broad.

- Emotion-related factors:
  - Impact of stress on the learner (3), including the importance of pre-planning and set up on stress reduction (2)
  - Student engagement and attention (2)
  - Mindfulness (1)
  - Importance of emotion in learning (1)
  - The power of humor and fun (1)
• Brain functioning:
  o Formation of and factors which impact long term memory (1)
  o Learning through self-discovery vs. being given the information (1)
  o Evoking brain response (1)
  o Importance of somatic learning to brain function in learning (1)

• Somatic factors:
  o Impact of the physical environment on the learner (2)
  o The importance of pre-planning and set up on stress reduction (2) (also listed under emotion-related factors)
  o The importance of somatic learning to brain function in learning (1)
    (also listed under brain functioning)

• Socialization
  o Integrated living systems (1)
  o Gender variations and tendencies (1)
  o Customizing methods to reflect context (1)

The breadth of responses indicates that participants look to neuroscientific findings to expand their understanding of the issues that are of most interest to them when teaching adults.

Comparing participant knowledge of adult learning theory and learning-related brain research.

Two participants rated themselves as less knowledgeable (P2, P6) and two as more knowledgeable (P3, P5) of adult learning theory than learning-related brain research, while the remaining two (P1, P4) rated their knowledge levels as equivalent.
When it came to which source they knowingly incorporated into their work, an equal number of participants rated adult learning theory as more important (P1, P3, and P5) than those who favored neuroscientific research (P2, P4, and P6). However, most participants rated themselves only one point different between the two sources; only the two more experienced educators had clearer preferences.

**Interpretation of learning-related brain research.**

As seen in the Literature Review, neuroscientists, educational researchers and educators interpret neuroscientific findings. The next set of Survey Questions (SQ9a) ascertained whether the participants were direct interpreters of neuroscientific findings or whether they worked with the interpretations of others. Participants were asked to rate on a scale of 1 – 5, the level of accuracy of statements describing their interpretation and application of neuroscientific research – 1 meaning a statement was not accurate and 5 very accurate (Table 10).

<table>
<thead>
<tr>
<th>Table 10 Implementation vs. Interpretation (SQ9a)</th>
<th>Average</th>
<th>Median</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>• I consider myself an interpreter of neuroscientific findings – I read the scientific research and determine how it can be used to better teach adults</td>
<td>3.50</td>
<td>3.50</td>
<td>2.00 – 5.00</td>
</tr>
<tr>
<td>• I use my interpretations of neuroscientific findings and create applications and techniques that can be used in the classroom to better teach adults</td>
<td>4.00</td>
<td>4.00</td>
<td>3.00 – 5.00</td>
</tr>
<tr>
<td>• I use the other people’s interpretations of neuroscientific findings and create applications and techniques that can be used in the classroom to better teach adults</td>
<td>3.83</td>
<td>4.00</td>
<td>2.00 – 5.00</td>
</tr>
<tr>
<td>• I use the applications and techniques that I have developed when I teach adults</td>
<td>4.67</td>
<td>5.00</td>
<td>4.00 – 5.00</td>
</tr>
<tr>
<td>• I use other people’s applications and techniques when I teach adults</td>
<td>3.67</td>
<td>4.00</td>
<td>3.00 – 4.00</td>
</tr>
</tbody>
</table>
Participants first rated the level to which they considered themselves an “interpreter of neuroscientific findings.” This was the most complex level of interpretation possible where interpreters worked with the findings coming directly out of neuroscientific research – 50% rated themselves a “4” or “5” and the other half a “2” or “3”. For all but one participant, this rating was the lowest (or tied for the lowest) response for any of the statements in this section.

The next set of questions dealt with the interpretations participants used when creating classroom practices: To what level did they use their own interpretations, and to what level did they use other peoples’ interpretations. Responses in this section were mixed. Two participants rated the two sources as equivalent, two preferred their own interpretations, and two preferred those of other people. Although this pattern mirrors the ratings regarding their comparable level of knowledge of adult learning theory and learning-related brain research (SQ4, p. 60 and SQ7, p. 61), there is only a small correlation (.17) between the two patterns of responses.

The last set of questions asked participants to rate the extent to which they used teaching practices they had developed themselves, and the extent to which they used practices developed by others. Four of the participants (P2, P3, P4, and P6) rated the statement, “I use the applications and techniques that I have developed when I teach adults” as more accurate than, “I use other people's applications and techniques when I teach adults.” The other two participants rated these statements at the same level. For all participants, “I use the applications and techniques I have developed” was rated at the highest (or tied for highest) level of accuracy of any statement in this section. However, the difference in preference was one point or less for four of the participants.
Conclusions from the survey.

The survey identifies many conclusions regarding the level of experience and preferred resources of the participants, as well as the extent to which they interpret and apply developments in the field:

- *Experience using Brain-related Practices* - All the educators interviewed had a significant level of experience (5 - 25 years) incorporating learning-related brain research into their work with adult learners.

- *Experience with Alternative Practices* – All but one educator had experience teaching before incorporating learning-related brain research into their work, and could provide a “before and after” perspective on their experience in the classroom.

- *Philosophy of Life-long Learning* – All the educators kept informed on new developments and practices through a variety of methods, and continually evaluated the impact of their teaching methods on their students. Most indicated they actively sought out and tried out new classroom practices.

- *Knowledge of both Adult Learning Theory and Learning-Related Brain Research* – All the educators felt they were knowledgeable about the psychological/educational philosophies on adult learning (adult learning theory), as well as the neuroscientific research about adult learning. Each applied their knowledge in the development of practices for the classroom. This group of participants was equally split as to which source had a greater impact on their teaching.

- *Development of Own Practices for the Classroom* – This group of participants preferred (albeit by a small margin) to use teaching techniques and practices they
had developed. When formulating their own techniques, all but one participant relied almost equally on interpretations of neuroscientific findings developed by themselves and others.

- **Interpretation of Neuroscientific Findings**– Half the participants rated as a “4” or “5” (“5” meaning very accurate) the description “I consider myself an interpreter of neuroscientific findings – I read the scientific research and determine how it can be used to better teach adults.”

**Interview Results**

The purpose of the interviews was to get each participant’s perspective on the influence of neuroscientific findings on their work in the classroom. The interviews had seven sections:

IQ 1. Work participants do with students
IQ 2. Curriculum development
IQ 3. Participant’s role in the classroom
IQ 4. Additional teaching perspectives
IQ 5. Participants’ focus of attention
IQ 6. Personal impact of incorporating brain-based practices
IQ 7. Additional information

**IQ1. Work participants do with students**

The first series of questions established a basic understanding of the type of students and events for each participant, and asked participants to describe the elements of a successful event.

- What was the training about?
- Had you worked with this group of learners before?
- Did you work with a co-trainer?
• Did you design the training?

• What made it a successful training for you?

**IQ1a. What was the training about?**

The responses to this question were quite broad. Several categories emerged out of the data: the types of learners, the subject matter, the length of the events, as well as whether the participant worked with repeat audiences.

<table>
<thead>
<tr>
<th>Table 11 Types of Student (IQ1a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corporate employees</td>
</tr>
<tr>
<td>Educators</td>
</tr>
<tr>
<td>University students</td>
</tr>
<tr>
<td>Managers/Administrators</td>
</tr>
<tr>
<td>Other</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 12 Subject Matter (IQ1a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soft Skills</td>
</tr>
<tr>
<td>Teaching Strategies</td>
</tr>
<tr>
<td>Neuroscience theory</td>
</tr>
<tr>
<td>Facilitation</td>
</tr>
</tbody>
</table>

With regard to the type of learner (Table 11), most of the educators taught in more than one setting. Four taught business employees (P3, P4, P5 and P6), three taught other educators (P1, P2, and P6), two were university instructors (P5, P6) and one taught parents of school-age children (P2).

The subject matter (Table 12) taught by this group of participants was mostly soft skills such as communication, leadership, mediation and conflict resolution, teaching skills, team building, etc. Two of the participants (P2, P3) stated that they taught neuroscientific findings as a content segment of their curriculum. One participant considered their work facilitation rather than teaching (P4).

Participants also talked about the length of events (Table 13, p. 68) and whether they worked with the students for more than one event (Table 14, p. 68). Every participant held half
day and full day workshops. The two educators who worked in both university and business environments (P5, P6) held classes only in the university setting. The participant who offered a series of classes in a corporate setting described it in this way:

Typically I'll go in anywhere from two to four hours with a group, but have that spread over time. I might show up there once a month for four to six months, breaking the skill sets into small chunks. I would do half a day this month, and then the next month I would come back and introduce a different skill set or a different concept. (P3)

P2, P4, P5, and P6 had experience presenting workshops that lasted more than one day.

**IQ1b. Had you worked with this group of learners before?**

As seen in Table 14, three (P1, P5 and P6) of the five people who taught in a workshop format and the one participant who saw the events as facilitations (P4) worked with new audiences every time. The others worked with a mix of new and returning students.

<table>
<thead>
<tr>
<th>Table 13 Length of Event (IQ1a)</th>
<th>Table 14 New vs. Repeat Audience (IQ1b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than ½ day</td>
<td>Workshops and Facilitations</td>
</tr>
<tr>
<td>½ day</td>
<td>New each time</td>
</tr>
<tr>
<td>Full Day</td>
<td>Mix of new and repeat</td>
</tr>
<tr>
<td>Multiple Days</td>
<td>On-going classes – repeat</td>
</tr>
<tr>
<td>On-going classes</td>
<td></td>
</tr>
</tbody>
</table>

3

4

6

3

3

3

**IQ1c. Did you work with a co-trainer?**

P1, P2, P3 and P6 usually worked alone when leading a class (Table 15, p. 69); only one educator worked mostly with someone else (P4). For participants who did work with a co-educator, half stated that the size of the group determined whether they would need a partner.
P3 explained, “Typically if the group is bigger than about 15 people and we’re doing any kind of in-depth training, I like to bring in a second person. ... We can split up the work and be able to be closer to what’s happening in the room.” All the work done in a class setting was done solo, unless a guest speaker was brought in on special occasions.

**IQ1d. Did you design the training?**

The next set of questions in the interview focused on who designed the curriculum (Table 16). The results show a parallel with the preference to work with others in the classroom. The same participant who preferred to work with others in the classroom also preferred to co-design the curriculum, whereas the rest of the people stated that they usually designed the curriculum themselves.

<table>
<thead>
<tr>
<th>Table 15 Work Alone or With Others (IQ1c)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mostly teaches alone (workshop)</td>
</tr>
<tr>
<td>Mostly teaches with others (workshop)</td>
</tr>
<tr>
<td>Co-teaches if the group is beyond a certain size</td>
</tr>
<tr>
<td>Teaches alone (class)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 16 Designers of Curriculum (IQ1d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Designs the curriculum alone most or all of the time</td>
</tr>
<tr>
<td><em>Sometimes designs with others</em></td>
</tr>
<tr>
<td><em>Includes someone else’s proprietary information</em></td>
</tr>
<tr>
<td><em>Considers material proprietary</em></td>
</tr>
<tr>
<td>Co-designs the curriculum most or all of the time</td>
</tr>
<tr>
<td>Customizes the material for the audience</td>
</tr>
</tbody>
</table>
Five participants (P2, P3, P4, P5 and P6) specifically stated that they customized their material to reflect the individuals and/or organizations they were teaching. This included integrating learning objectives (P3, P4, P5 and P6) into the curriculum, as well as individual learning styles or needs (P3, P4). P1 included material in their curriculum for which they paid royalties; P3 created material that they considered “proprietary.”

**IQ1e. What made it a successful training for you?**

For the closing question in this section, participants recalled events that they considered successful, and then identified the factors that indicated success (Table 17).

<table>
<thead>
<tr>
<th>Table 17  Indicators of a Successful Event (IQ1e)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Engagement level in the room</td>
<td>5</td>
</tr>
<tr>
<td>What happens after the event</td>
<td>3</td>
</tr>
<tr>
<td><em>Student attitude when leaving the event</em></td>
<td>2</td>
</tr>
<tr>
<td><em>Students committed to practice the material in the future</em></td>
<td>2</td>
</tr>
<tr>
<td>Incorporate neuroscientific-based methods into the curriculum</td>
<td>3</td>
</tr>
<tr>
<td><em>Experiential</em></td>
<td>3</td>
</tr>
<tr>
<td><em>Movement</em></td>
<td>2</td>
</tr>
<tr>
<td><em>Time to process</em></td>
<td>2</td>
</tr>
<tr>
<td><em>Connect to student’s experience</em></td>
<td>2</td>
</tr>
<tr>
<td>Work done before the event</td>
<td>2</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
</tr>
</tbody>
</table>
The most consistent answer, given by five participants, was the level of engagement in the room during the event. The terms used most often were “engaged” (P2, P4, P5, and P6); “happy” (P1, P4) and “energy levels”/“levels of energy” (P4, P5).

Half (P1, P3 and P4) the participants felt that what happened after the event was also an important measure of success. This had as much to do with the students’ attitude at the end of the event (P1, P4), as it did their level of commitment and established plans for continued future practice of what they had worked on during the event (P1, P3).

Half the participants (P1, P2, and P3) indicated that a measure of success for them was the level to which they incorporated neuroscientific-based practices into their curriculum and presentation. The neuroscientific findings most important to success were experiential practices (P1, P2, and P3), incorporating processing time (P1, P2), incorporating movement (P1, P2) and connecting the new learning to the student’s experience – this included building on past knowledge and finding the relevance of new knowledge (P1, P3). Only two participants (P2, P3) listed work done before the event (meeting students, assessments, room set up) as integral to the success of an event. Other factors listed by individual participants included how they personally felt about the event (P5) and direct feedback from students (P6).

Conclusions from IQ1a-e: Work participants do with students

The responses from the first set of questions in the interview provide an overall picture of the type of work done by the participants in the study. Two observations stand out from this section: a) the participants all taught soft-skills and b) five out of the six participants felt that student engagement was a strong indicator of the success of an event. The first point is

---

3. Note that in a later question about curriculum elements (p. 79), all participants considered the integration of neuroscientific findings integral to curriculum design.

4. Note that in a later question about curriculum elements (p. 77), five out of the six participants indicated that they performed some sort of pre-event assessment.
important because it helps eliminate differences in content as a variable when looking at participant choices regarding curriculum development and interaction with students. The second point provides insight into the mindset of the participants when they teach and the goals they have about the learning process. For example, participants did not say, “covered all the material” or “fulfilled the learning objectives for the day;” their focus was on engagement – student connection to the material and the mood in the room. Below is a summary of all the factors discussed under Question 1 of the interview.

- **Student type** – Participants worked with a variety of adult students from the business and academic sectors.
- **Subject matter** – Participants taught primarily soft skills such as communication skills, team building, conflict resolution, and teaching strategies.
- **Event Length** – Participants held events of various lengths from a couple of hours to multiple day workshops. Half of the participants taught in a class setting.
- **Repeat Students** – When participants taught in a workshop format, half of them had a new set of students every time. All events held in a class format had repeat students.
- **Co-educator** – Four out of six participants taught workshops alone, unless the size of the group was large enough to warrant a co-educator. One participant preferred to teach with a co-educator and the last worked with a co-educator half the time. In a class setting, all participants taught alone.
- **Co-designer** – The same participant who tended to teach with a co-educator also favored co-designing events. All other participants preferred to design the curriculum on their own. All but one participant specifically stated that they
customized events to fit the needs of the client organization. Only one participant paid royalties to use proprietary material.

- **Success Factors** – The greatest measure of a successful event was the level of engagement of the students. Only two participants attributed success to work done before the event, and three to work done after. Half of the participants named incorporating neuroscientific-based methods into the curriculum a success factor.

**IQ2. Curriculum development.**

The second set of interview questions centered on the influence of neuroscientific findings on a participant’s choices around curriculum design. The original questions for this section were: What elements did you include in your curriculum that were specifically designed to address how the brain learns best? Do you follow one specific approach / methodology? What kind of advanced planning did you do? However, after the completion of all the interviews, it became clear that participants provided insight on their curriculum design choices throughout their interview. Including responses obtained from other sections of the interview in this portion of the study created a more accurate portrayal of curriculum design. As a result, responses gathered from the entire interview were categorized under two questions:

- Do you follow one specific approach / methodology?
- What elements did you include in your curriculum that were specifically designed to address how the brain learns best?

**IQ2a. Do you follow one specific approach / methodology?**

Over the last twenty years, scientists and educators have interpreted cognitive Neuroscientific findings for use in the classroom. The Literature Review (p. 34) focuses on two methodologies: Accelerated Learning practices and Brain-based applications.
As seen in Table 18, all participants reported that they did not rely on one methodology alone, but tended to bring in experiences and findings from a variety of brain-related fields. P1 explained, “I take a little bit of everything – it’s a very pragmatic approach rather than a systemic one.” Brain-based applications such as those developed by Jensen, Caine and Allen strongly influenced two participants (P1, P2). Three participants integrated methods and approaches developed in areas of neuroscience that were of particular interest to them, such as multiple intelligence (P2), skill encoding (P3), altruism (P3), and creative thinking (P4). One participant’s (P6) curriculum design integrated Accelerated Learning methodologies, especially as interpreted by David Meier.

<table>
<thead>
<tr>
<th>Table 18 Preferred Methodologies (IQ2a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Works with a mix of sources</td>
</tr>
<tr>
<td><em>Develops methods based on their own interpretations of neuroscience</em></td>
</tr>
<tr>
<td><em>Integrates methods and approaches developed by Neuroscientists</em></td>
</tr>
<tr>
<td><em>Integrates methods and approaches developed by Brain-based educators</em></td>
</tr>
<tr>
<td><em>Integrates methods and approaches of Accelerated Learning</em></td>
</tr>
<tr>
<td><em>Integrates methods and approaches develop under other methodologies</em></td>
</tr>
</tbody>
</table>

It was clear from the responses, that each educator integrated practices they felt resonated with their values and beliefs about learning, and that they felt had a positive impact on the learning happening in their classrooms. P6 stated it this way, “I’m always kind of looking for those connections between the research and what I think works.” P1, P2 and P5 also specifically stated that neuroscientific findings affirmed and validated their approach in the classroom.
In addition to neuroscience-based practices, five participants identified other approaches that they incorporated into their work such as Appreciative Inquiry (P4), Neuro-Linguistic Programming (P3, P4), Shamanism (P4), adult learning theory (P5), linguistics (P3), Psych K (P4), the Tribes Program (P2), and an un-named proprietary source (P1). Half the participants (P2, P3, and P4) included their own interpretations of neuroscientific findings in curriculum design. The interviews also revealed that two of the participants had written their own books (P1, P2), while a third (P3) was in the process of writing a book.

**IQ2b. What elements did you include in your curriculum that were specifically designed to address how the brain learns best?**

The following analysis incorporates any interview response that pertained to the elements included in the design of the curriculum. Many times this information was a minor part of the question asked. However, the responses for the following questions are analyzed in their entirety in this section, and will not be presented later in their original context. The location of the question in the original interview design is in parentheses. These questions no longer stand alone, and their responses are integrated throughout this section.

- What elements did you include in your curriculum that were specifically designed to address how the brain learns best? (From Curriculum Development)
- What kind of advanced planning did you do? (From Curriculum Development)
- Do you deal with people’s physical state / needs during the training? If, yes, how? (From Interaction with Students)
- Do you deal with people’s emotional state / needs during the training? If, yes, how? (From Interaction with Students)
After considering all the responses, it became clear that even though participants draw from a variety of neuroscientific interpretations and methodologies, and teach to different audiences during a variety of event lengths, there is consistency to the curriculums design (Table 19). Nearly everyone includes elements in this order: Preparation, Presentation, Processing, Practice and Promotion.

**Table 19 Curriculum Elements (IQ2b)**

<table>
<thead>
<tr>
<th>Element</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Preparation</td>
<td>6</td>
</tr>
<tr>
<td>B. Presentation</td>
<td>6</td>
</tr>
<tr>
<td>C. Processing</td>
<td>6</td>
</tr>
<tr>
<td>D. Practice</td>
<td>5</td>
</tr>
<tr>
<td>E. Promotion</td>
<td>6</td>
</tr>
</tbody>
</table>

Superimposed over a time line of an event, these elements would be as follows:

**Chart 1 Event Timeline**

5. The terminology of this sequence strongly parallels Meier’s Four Phase Learning Cycle: Preparation (arousal of interest), Presentation (encounter of new knowledge), Practice (integration of knowledge) and Performance (application of knowledge to real world situations) (Meier, 2000. p. 53). However, the intention and steps of phases described in this study correspond only in part to those with of the same name in Meier’s Cycle.


**Preparation.**

Defined as the work done for an event before participants present any material to the students, Preparation is integral to the event itself. In the words of P3, “Before the training is an important aspect of the training.” The critical elements that make up the Preparation phase for participants (Table 20, p. 78) include staying informed and assessing learning needs (identified in the chart as “research”), designing the curriculum, as well as addressing student’s physical and emotional needs before the start of the event.

**Keep up with developments in the field.**

Participants identified the work they do to keep informed on issues regarding neuroscience and adult learning as fundamental to their preparation. Each actively kept up with developments in the field, and/or reviewed existing materials and integrated elements from this review into their curriculum or presentation. “It is reading and going to conferences and totally making myself immersed in as much of the cognitive neuroscience research that’s coming out. Trying to keep myself updated – that’s my behind the scenes homework” (P2).

The findings in this section reflect the findings of the survey: Participants read materials written by neuroscientists (P2, P3, P4, and P5) and interpreters of research (P1, P4, and P6), as well work done in other fields related to adult learning (P4, P5).

**Assess student preferences, objectives, practices and/or relationships.**

All but one participant (P1) stated that they performed a pre-assessment of some kind. The pre-assessment can vary depending on what the client organization will allow and can range from getting learning objectives and information from management, to surveying or interviewing some or all of the students. P2 stated it in this way, “Understanding my audience is the first
consideration …, and then of course finding out … what kind of common language or experiences they have.”

<table>
<thead>
<tr>
<th><strong>Table 20 Preparation</strong> (IQ2b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keep up with developments in the field</td>
</tr>
<tr>
<td><em>Read work of neuroscientists</em></td>
</tr>
<tr>
<td><em>Read work of interpreters or educators</em></td>
</tr>
<tr>
<td>Assess student preferences, objectives, practices and/or relationships</td>
</tr>
<tr>
<td><em>Discover learning objectives, group dynamics and/or needs</em></td>
</tr>
<tr>
<td><em>Understand students and/or organizational culture</em></td>
</tr>
<tr>
<td>Prepare curriculum</td>
</tr>
<tr>
<td><em>Incorporate neuroscience based practices</em></td>
</tr>
<tr>
<td><em>Try new approaches or new combinations</em></td>
</tr>
<tr>
<td><em>Assign work before the event</em></td>
</tr>
<tr>
<td>Address student’s physical needs before presentation</td>
</tr>
<tr>
<td><em>Set expectations about breaks, as well as acceptable behaviors</em></td>
</tr>
<tr>
<td><em>Set up the room and/or environment</em></td>
</tr>
<tr>
<td><em>Give people responsibility for taking care of their own physical needs</em></td>
</tr>
<tr>
<td>Address emotional needs before presentation</td>
</tr>
<tr>
<td><em>Influence the mood of the room before the presentation portion begins</em></td>
</tr>
<tr>
<td><em>Set expectations about ways in which the group will interact</em></td>
</tr>
<tr>
<td><em>Take steps to prepare mentally and emotionally for the event</em></td>
</tr>
</tbody>
</table>
Two participants expressed that this assessment goes beyond gaining insight into the group. P4 explained, “I generally try to reframe things in the needs assessment because I feel that starts the process of learning. People begin to think about things differently before they come into the training room.” P3 used the assessment as a way to build trust before the event:

When I walk in, because they know me, because they’ve had conversations with me, they trust me and they can actually dive in much deeper for issues in a short period of time than they could if I were just walking in off the street.

*Prepare curriculum.*

Curriculum development is inherently part of the Preparation phase and each participant includes elements based in neuroscientific findings. The design of the curriculum combines the participant’s experience level, their continually updated knowledge of adult learning, and the needs of the group they will be teaching.

It should be noted that the interview question regarding curriculum focused on the elements the participants chose to include, not on any structure they might follow when designing an event. Only two participants (P2 and P6) specifically talked about the design of the curriculum as following a structure. P6 primarily used Meier’s Accelerated Learning format (2000) as a foundation. P2 followed a three-step process based in part on the work of Renata Caine (1994, 2005): 1) relaxed alertness – build a safe and secure environment, 2) do the real thing – connect the learning process to theory and experience, and 3) use it or lose it – process the new information. In describing their curriculum development process, the other participants were more likely to talk about incorporating learning objectives or identifying a small set of curriculum elements that they preferred to do in a particular order. Examples included, always follow presentation with processing (P1); do a short presentation followed by demonstration,
then role-play then debrief (P5); close with a story (P1); and follow linear activities with non-linear (P4).

On a basic level, however, events have a consistent structure: they begin with an introductory period, end with a closing period, and in between have a continuous cycle of presentation, processing and application (See Chart 1, p. 76). Although participants rarely talked about an introductory segment specifically, each of them described a period before they started presenting material where they reviewed guidelines, expectations, and/or agendas for the event. Similarly, a closing period was rarely identified; however, each participant indicated they included practices done at the end of an event. The sections on Presentation, Processing, Practice and Promotion below provide a fuller explanation of these elements.

Because each participant kept up with developments in the field, they regularly came across new research or approaches that resonated with their approach in the classroom, and often they incorporated them into their curriculum. Most of them took the approach described by P1, “What I do is I try things…. I will bring in new strategies into the curriculum, and if something works, great, I keep it. If it doesn’t work, I try to figure out why it doesn’t work, and then I’ll just discard it.” P4 explained that for each new set of students she performed an “intuitive scan” to see what curriculum elements and materials would work best for that particular event.

Four of the participants occasionally assigned work for students to complete before they attend the event. P5 and P6 did this as part of their university classes. P4 determined the need for preliminary work during the assessment, and sometimes asked students to do a short exercise or read an article before the event. Whenever organizations were able to purchase her book before an event, P2 suggested that students review the information beforehand, and then use the book as a study aid after the event.
Address student’s physical needs before the presentation.

All participants addressed the somatic aspects of learning during the Preparation phase. During the introduction, each participant set expectations and/or acceptable norms around student’s individual physical needs including taking breaks (P1, P3), getting food and drinks (P2, P3, P6), and not using disruptive technology such as cell phones and laptops (P2, P3). In addition, five participants (P2, P3, P4, P5, and P6) specifically talked about empowering students to take responsibility for their own physical well-being. In the words of P5, “I’ll often help create working agreements with ground rules to encourage people to take responsibility for their own health and just what they need to do to take care of themselves.” Some participants mentioned setting up the room in a way that supported the physical aspects of learning including:

- Arrangement of tables and chairs (P2, P3, P5, and P6)
- Availability of food or refreshments (P3, P6)
- Access to soft or natural light (P3, P4, and P6)
- Interaction with plants or nature (P3, P4)
- Accessibility of materials (P2, P6)
- Preferences of students reflected in the classroom (P2, P6).

Address emotional needs before the presentation.

All participants addressed the emotional aspects of learning during the Preparation phase. The tone of the responses reflected each participant’s interest in creating an environment that reduces stress and establishes a sense of safety. P6 explained, “I think I do a lot in the preparation of the room. [Establishing] an open friendly environment creates good emotions, good feelings and good expectations about what is going to happen that day.” Five participants (P1, P2, P3, P5, and P6) described ways in which they purposefully tried to influence the mood
of the students before the Presentation phase using music (P1, P6) and humor (P1, P2, P3, P5, and P6). Participants P3 and P4 took steps to prepare themselves mentally and emotionally before the start of the event.

Four participants talked about setting expectations and/or acceptable norms regarding individual and group interaction during the introduction, including discussing issues such as awareness of impact on others (P3, P4), dismissing new ideas too quickly (P2), and confidentiality (P5, P6). P2 specifically let students know from the beginning that she will be checking in on their emotional “pulse” from time to time throughout the event. P3 used the time when students enter the classroom to help prepare for issues of group dynamics, “If I’m there early enough to be completely set up by the time the first person comes in, then I’m able to talk to people as they come in and just observe what the dynamic of what’s going on in the room.”

**Presentation.**

Presentation is the portion of the event when participants impart new material or skills, as well as review previously known information (Table 21).

<table>
<thead>
<tr>
<th>Table 21 Presentation (IQ2b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keep it short</td>
</tr>
<tr>
<td>Follow immediately with processing</td>
</tr>
<tr>
<td>Build on prior knowledge</td>
</tr>
<tr>
<td>Demonstrate or model new material</td>
</tr>
<tr>
<td>Be explicit about the learning process</td>
</tr>
</tbody>
</table>

There is consensus among the participants around this phase: the time spent on presentation should be short; any new material should be immediately followed by exercises or discussion so students have a chance to process the information; new information should be
connected to prior experience; presentation of new material should include demonstration or modeling. In addition, most of the participants felt that the educator should explain not only the material or skills, but also the theory behind the learning process.

*Keep it short and Follow immediately with processing.*

Participants felt it was important to keep short the time they took to present to the students. P1 explained,

> The human mind can only take in so much information before it dumps it because something else is coming in. Unless you can wrestle with it, grapple with it, think about it, talk about it, it’s gonna leave because the hippocampus decides, ‘Well, you don’t seem to be doing anything with this,’ so it just spits it out, and it’s gone.

P5 was more specific, “short-term memory apparently can focus on up to seven items at any point in time.” As a result, all the participants usually limited their presentation time to between 5 and 20 minutes (Table 26, p. 95) before they moved on to an exercise or activity that would allow students to work with the new information/skill. Everyone indicated that the presentation of new information should be immediately followed by time to process that material. However, in keeping presentation time short and allowing more processing time, participants sometimes had to limit the amount of material they could cover in one event.

> The master of all that is not trying to cram too much in and making sure that my agenda has limits. Sometimes I get almost coerced by the professional development booking coordinator, ‘Could you work in this [content]? Could you work in that?’ They want a three-day training in one day. Limiting the scope of the content so that I can allow for processing is really an art, and some of that you just learn with experience. (P2)
Build on prior knowledge.

Another critical part of learning for all participants was helping students connect on a personal level with the new material or skills. Participants accomplished this in a variety of ways including having students share their experiences with others, discuss their reactions to the material, explore the application of the new material to their existing situations, etc.

Demonstrate or model new material.

All but one of the participants (P3) explicitly stated that they demonstrated or modeled what they would like students to learn as part of their Presentation. P5 explained his reasoning, A big part that really motivated me more than anything was the research around mirror neurons and how the brain is designed to learn by observation in a very natural kind of a way. … People learn best, especially soft skills, by being able to watch and see skills demonstrated.

P1 liked to demonstrate a skill or concept before naming it to keep students from being sidetracked by terminology. P3 placed emphasis on helping students cultivate “an awareness of their internal process: what’s happening in their body, the thoughts that they’re having, the belief systems that are guiding their choices, maybe their habitual language patterns.”

Be explicit about the learning process.

Four participants (P1, P2, P3, and P5) felt the learning process was enhanced when students were told about the underlying theories and findings regarding the learning process. P2 explained, “They want all these things that they can use right away but I feel compelled to also balance it with kind of the background in theory or why it works so I’m not just giving them what I call gimmicks or cute ideas.” P3 also incorporated transparency around the learning process to address concerns students might have about the non-traditional teaching practices she
uses, “Sometimes being able to articulate to people what’s going on in the brain, helps them to understand and buy into this kind of learning.”

**Processing.**

In this study, the Processing phase refers to the period when students work, either individually or in groups, with the new knowledge and skills introduced in the Presentation phase. The goal is to allow students to actively interact with the material and test out whether it makes sense to them: understanding the material, its relevance and application. Processing can happen in a variety of ways including discussion, activities, exercises, problem solving, role-play, etc. During the interviews, every description of events included processing time, because “a good deal of evidence in the research talks about how important it is to allow people to process information” (P1).

Table 22 outlines the core elements of the Processing phase: safe environment, social interaction, real-life associations, somatic learning, emotional connections, and varying approaches. These elements are consistent among all the participants, regardless of their neuroscientific focus, preferred methodologies, event content, event length, or student type.

<table>
<thead>
<tr>
<th>Table 22 Processing (IQ2b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintain a safe yet engaged environment</td>
</tr>
<tr>
<td>Incorporate social interaction</td>
</tr>
<tr>
<td>Make connections to real life experiences</td>
</tr>
<tr>
<td>Incorporate somatic learning</td>
</tr>
<tr>
<td>Incorporate emotional connections</td>
</tr>
<tr>
<td>Vary ways in which people process information</td>
</tr>
</tbody>
</table>
Please note that some participants use the term “processing” to refer to the verbal or intellectual ways in which students work with new information or skills, what P3 describes as “When the group is thinking about it and talking about it, and practicing it.” To identify the more somatic or complex practices used in processing, participants use the term “activity” (P1, P2, P3, and P6) and/or “exercise” (P3, P4, and P5). For the purposes of this study, activities and exercises are part of processing; however, practice is not.

*Maintain a safe yet engaged environment.*

All of the participants were conscious of maintaining the emotional environment that they had established during the Preparation phase. Five of the participants (P2, P3, P4, P5 and P6) talked specifically about building on the work done during the pre-assessments and introduction, by monitoring interactions among the group members in order to support healthy interactions. Participants defined safety in terms of a foundation from which the students could become engaged in the material:

People have to feel like the environment is emotionally safe enough for them to take a risk. But, if it’s too safe, then they can get very complacent so there’s kind of a balance there. … I want to create a balance of challenge and safety in the room because challenge is what engages the brain, and the dopamine production and the new learning. Safety is what makes that process possible. (P3)

Keeping stress levels low was a critical element to increasing safety and engagement: “The art of the work is to de-stress the system as much as possible so learning can actually occur” (P4). In order to accomplish this, all participants incorporated breaks into the curriculum, and included practices that were physically active, interactive, fun, and/or relaxing. At other times, this work happened in the moment:
I do try to be attentive to what’s going on in a group as a whole, what’s going on with individuals. I try to rely a lot on my ability to read the body language and to sense whether they’re engaged or not. It’s really a continual monitoring and sensing and based on that, I make my intervention choices. (P5)

*Incorporate social interaction.*

A critical part of the learning process, as recognized by all the participants, was the interaction between students. P2 explains, “The brain retains more information” if we have to put things into our own words or understand someone else’s interpretation of the material. P4 adds another layer, “I’m encouraging them to form smaller groups for various kinds of activities, with different people so that the complexity of the neural network that can be associated with a particular training is increased.” Inherently each explained in their own way,

Every person is bringing this incredible wealth of knowledge and experience into a training, and to elegantly design ways where the greatest amount of that can be shared with the largest number of people in the group is, to me, one of the real challenges of doing great training. (P4)

*Make connections to real life experiences.*

All participants felt that the new material and skills presented during the event should be linked to the students’ real life experiences. P2 explains, “Brain research about brain plasticity or neuro-plasticity” shows that “when we do real things” it actually promotes “brain growth and development.” During the Preparation and Presentation phases, participants focused on building new knowledge upon the foundation of the students’ prior experience. During the Processing phase, students continued to look for relationships between old and new knowledge and then began to explore how the new material could be applied to real-life situations.
It’s a constructivist process, where they take what they already know and combine it with the information I’m giving them, or they’re learning from other people in the group. By the time they leave me, they have a good many things that to them are new or newly constructed. It’s the difference between information and knowledge. (P1)

_Incorporate somatic learning._

All participants were emphatic about including movement into the fabric of the event. Each provided examples of exercises where students were standing, walking, stretching, or in some way interacting physically with each other. In addition, when the curriculum did not support an active exercise, participants included movement by having students go to a different part of the room, gather materials, change groups etc. “Movement is connected to memory; I will have people move frequently” (P1).

Examples of somatic learning went beyond physical movement. For example, P5 explained, “I’m forever thinking about the engagement of as many senses as possible. That influences my curriculum design.” P1, P4 and P6 incorporated music or sounds either in the background or as part of an activity in part to stimulate the sense of hearing. P4 sometimes had “people making sound patterns” or led students on a “short guided visualization.” In order to increase student awareness of their reactions in particular situations, P3 and P5 incorporated somatic exercises designed to stimulate specific emotional responses.

I sometimes will have people do exercises where they push against each other and just experience in their body what their automatic reaction is to being pushed. Then [I point out] …, here are some language patterns or here are some thought patterns that you might want to start connecting with that feeling in your body. …
[Afterwards] I might have somebody physically push on somebody while the
other person practices vocalizing a new language pattern so that it’s an actually in
the body experience of not only practicing it but connecting to what the
[emotional] context will be. (P3)

_Incorporate emotional connections._

The sections “Maintain a safe yet engaged environment” and “Address emotional needs
before presentation” explored the importance that participants placed on creating and
maintaining a learning environment that was emotionally safe and had low levels of stress.
Participants considered and worked with the student’s emotional state in a variety of ways.

All participants talked in some way about being conscious of peoples’ moods and then
used interventions to keep students engaged in order to maximize the learning in the room. P3
described it as “managing the emotional climate within the session itself.” P4 researched group
cultural preferences in order to “anticipate emotional needs by offering a curriculum in a format
or in a way that helps to satisfy those needs.” P1, P2, and P5 used humor and laughter to keep
things fun.

The most powerful learning with adults, in my experience, is when I use more of
the techniques that I might even use with middle school and high school kids. If
it’s joyful, if it has novelty, if it can be playful….all of those great techniques …
work with teachers as well. (P2)

When necessary, P3 and P4 helped “ground the energy of the group” (P4) or individuals
(P3) by having students focus on their current physical or emotional state, or through specific
physical activities. P1, P4, and P6 used music and rhythms to affect the mood or the group as
needed: re-energizing, calming, bonding, etc. As seen in the examples given in this and the
previous section, the physical and the emotional were seen to influence each other. When asked to differentiate between the two environments, P6 put it in this way, “Well, I think it’s one and the same in a lot of ways.”

All participants talked about creating situations where students could experience a moment of discovery or breakthrough.

That “yeah” feeling that you get when you’ve discovered something and you’ve made the connection. It’s actually a surge of dopamine in the brain that facilitates encoding the new information. So, there’s a direct link between people having that moment of discovery and their ability to remember and apply it later. (P3)

P1 and P5 linked memory and emotion explaining that, “emotions enhance memory” (P1). Sometimes participants purposefully stimulated a strong emotional response in order to influence learning.

In a specific context, I may even create a situation where people experience a strong emotion. I’m a big believer in allowing people to feel what they’re feeling and not to stifle them. So, if people do express strong feeling in a context of a training, I don’t try to squelch that, but I try to listen to them and validate and hear what it is that they’re saying, and see if I can get to what’s the need … that’s not being met. (P5)

P2, P3, P4, and P5 incorporated elements designed to increase both confidence and self-awareness levels in their students. P3, P4, P5, and P6 each gave examples of supporting students who had a strong emotional response during the event. P4 assigned different roles or responsibilities to students to support their personality preferences; P2 allowed students to choose their own exercises, in order to support the multiple intelligences in the room.
Four participants reported being explicit with students about the role of emotions in learning. P5, when teaching conflict resolution, described modeling vulnerability thereby “encouraging and orienting them [students] to that, and encouraging them to do the same.” P2 cultivated in her students an awareness of their internal processes by occasionally checking in with them on their emotional state using a process explained during the introduction period. P3 and P4 used pre-assessments to identify potentially emotionally difficult issues and then dealt with them directly either in the design of the curriculum or in the moment:

I will not go forward when there is an elephant in the room and we're all pretending that we're doing something. I kind of sniff those out, then I say, ‘What's going on?’ … I’m usually successful in getting [the issue] out, getting it on the table, and then just proceeding along; but, at least it's been articulated even if it's not a problem we can solve. (P4)

P3 also acknowledged students’ discomfort during the learning process and addressed it directly to “create a level of buy-in,”

You might feel like this is moving too slowly for you or you feel like you’ve got the concept. [You might be thinking] ‘Let’s move on,’ ‘Why are we doing this stupid role play?’ or ‘I feel uncomfortable.’ This discomfort is normal, and this in fact is the only efficient way to really learn and master the material.

Vary ways in which people process information.

Exposing students to a variety of different ways of processing was another critical factor identified by participants. P5 explained, “The brain is designed to forget everything.” “If we don’t process it in several different ways, and even over time, then there’s a very good chance the brain won’t perceive that as being important and really wire it into long term memory” (P2).
P1 explained, “The brain constantly switches gears” and “the brain craves novelty,” “so [I’m] constantly in search of ways to change people’s physical or mental state.” Throughout the interviews, participants used terms such as “balance” (P2, P3), “rhythm” (P4, P5), and “state changes” (P1), to describe the constant shifts they made to stimulate different kinds of processing. Practices were combined to stimulate different ways of learning, including:

- Linear and non-linear
- Verbal and non-verbal
- Sitting and moving
- Intense and relaxed state
- Challenge and safety
- Talking and listening
- Right and left brain
- Facts and metaphor
- Working in small and large groups
- Presentation and processing
- Working in groups and alone
- Physical contact and separation
- Staying inside and going outside
- Hands-on experience and visualization
- Stimulating various senses
- Stimulating different intelligence.

In addition to creating a sense of novelty, the change in approaches also served to re-energize the group: “Something to help refresh the chemistry of the brain so that the brain chemistry that is called upon to perform linear functions isn't exhausted and then overworked” (P4). P4 also believed that although western culture was more comfortable with linear thinking, educators should find ways to have students stay in a non-linear mode because it could be a greater source of creative solutions.

**Practice.**

Beyond discussing, processing and brainstorming about the new material and its application, P1, P3, P4, P5 and P6 specifically talked about including opportunities to practice the new learning during the event (Table 23). P3 lamented, “There’s a great deal of denial often
times about the need for practice,” and understood that if she just provided content without practice, when people tried to apply the new learning, “what will get applied is [old] habitual patterns.” Each of these participants incorporated role-play, practicum or repetition into their events to provide students the opportunity to reinforce new learning. P6 also looked for “something that allows me to either observe that they’ve got it or they produce something written proving that they’ve got it.” Although the cycle of Presentation and Processing repeats often within an event, the Practice phase is not included each time. Often a participant had students go through several cycles of Presentation and Process before they felt the group was ready for the Practice phase.

<table>
<thead>
<tr>
<th>Table 23 Practice (IQ2b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorporate opportunities to practice new learning</td>
</tr>
</tbody>
</table>

**Promotion.**

Although the participants rarely identified a closing period, all indicated that there was a time when they received feedback (P1, P2, P3, P5, and P6), presented a closing story (P1) and/or empowered students to continue the work done during the event (P1, P2, P3, and P4) – all elements attributed to a closing period (Table 24).

<table>
<thead>
<tr>
<th>Table 24 Promotion (IQ2b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bring the event to a close</td>
</tr>
<tr>
<td>Get feedback about the event from students</td>
</tr>
<tr>
<td>Empower students to continue the work started during the event</td>
</tr>
<tr>
<td>Tell a closing story</td>
</tr>
<tr>
<td>Integrate opportunities to practice after the end of the event</td>
</tr>
</tbody>
</table>
Half the participants (P2, P3, and P4) actively encouraged the creation of systems to practice and support the new learning after the end of the event. P2 and P4 tried to get agreement from management before the event to establish these systems. P2 indicated that she was able to get buy-in from management about 50% of the time; P4 said that was “not the norm.” P3 purposefully brainstormed this issue with students before the end of the event so, “they’re actually leaving the room with a process set up for reinforcing the skill.” Table 25 lists ways in participants encourage Practice after the event.

<table>
<thead>
<tr>
<th>Table 25 Post-Event Promotion Possibilities (IQ2b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2</td>
</tr>
<tr>
<td>• Professional learning community</td>
</tr>
<tr>
<td>• Discussions groups</td>
</tr>
<tr>
<td>• Book study group using her book</td>
</tr>
<tr>
<td>P3</td>
</tr>
<tr>
<td>• Coaching buddy</td>
</tr>
<tr>
<td>• Application plan</td>
</tr>
<tr>
<td>• Group tele-coaching with the participant</td>
</tr>
<tr>
<td>P4</td>
</tr>
<tr>
<td>• Reminder forms to help track progress</td>
</tr>
<tr>
<td>• Feedback group to review and support practice</td>
</tr>
<tr>
<td>• Community of practice (virtual or in person)</td>
</tr>
</tbody>
</table>

**Typical time frames for each phase of an event.**

As seen in the Event Timeline (Chart 1, p. 76), the Presentation, Processing and Practice phases follow each other repeatedly over the course of one event. The initial design of the interview did not include questions about the time spent on each phase. However, the timing factor was so important to the first three respondents that questions were added to the interviews of the last three participants regarding length of presentation and processing, as well as frequency of movement (how often they had people move around). The results shown in Table 26 (p. 95) are consistent with the findings described in the Presentation section (p. 82): most
participants kept the Presentation time short – often under 20 minutes. P2 and P5 allocated even less time; however, P5’s short presentation period was specific to events on mediation.

| Table 26 Typical Times Frames During Events (IQ2b) |
|----------------------------------|------------------|-----------------|-----------------|------------------|
|                                  | Length of        | Length of       | Length of       | Frequency of     |
|                                  | Presentation     | Processing      | Practice        | Movement         |
| P1                                | 10 - 20 min      | 30 - 45 min     | Not specified   | after 10 - 20 min|
| P2                                | 8 - 10 min       | 1+ min          | Not specified   | after 30 - 45 min|
| P3                                | 15 - 20 min      | 15+ min         | Not specified   | after 15 - 20 min|
| P4                                | 5 - 20 min       | 20 min          | 20 min          | after 20 min     |
| P5                                | 5 min            | 20 - 45 min     | 15 min          | Not specified    |
| P6                                | 10 - 20 min      | 20 min          | 20 min          | Not specified    |

Typical Processing periods varied greatly from a one-minute check in with a nearby student (P2), to 45-minute activities that were more involved. Still, participants shared examples of longer exercises, some lasting as long as an hour and a half. Half the participants (P1, P3, and P4) were conscious of inserting some kind of movement about every 20 minutes, P2 every 30-45 minutes. P5 was not specific about how often he had people move; nevertheless, he indicated that he incorporated movement through breaks and activities in his curriculum and then added unscheduled physical activity if the group’s energy or focus started to wane.

**Conclusions from IQ2 a-b: Curriculum development**

The responses from the second set of interview questions focuses on the choices participants made regarding curriculum development for an event. Because each participant describes elements affecting curriculum throughout their interview, this section of the study goes beyond its original design and incorporates responses from throughout each interview. Despite
the variety in findings regarding student type, event length, and repeat students from IQ1 (p. 66) as well as preferred methodologies from IQ2 (p. 73), there exists an overall consistency to curriculum design across all participants. In addition, the tone of these elements is consistent with the findings of IQ1 (p. 72) regarding the mindset of the participants: the focus remains on the student’s connection to the material.

An analysis of the responses shows that curriculums tend to follow a five-step process of Preparation, Presentation, Processing, Practice and Promotion. The phases include elements that occur before and after the event. However, consistency in curriculum design goes deeper than the identification of five phases – there is also consistency in the elements that make up each phase (Chart 2).

**Chart 2 Curriculum Elements**

- **Preparation**: Address Student’s emotional needs, Address Student’s physical needs, Design curriculum, Conduct pre-assessments, Keep up with developments in the field.
- **Processing**: Make emotional connections, Incorporate sonic learning, Feature social interaction, Maintain a safe environment, Very approaches.
- **Presentation**: Keep it short, Follow with processing, Build on prior knowledge, Demonstrate new learning.
- **Practice**: Encourage connections to real-life.
- **Promotion**: Encourage practice, Establish support systems.
• **Preparation** – The participant prepares for the event by combining experience, research on learning and assessments of student needs to create a curriculum for the event. At the beginning of the event, participants address how students’ emotional and physical needs will be supported during their time together.

• **Presentation** – The participant presents material to students in short segments (usually 10 - 20 minutes) followed immediately by processing time. The presentation builds on the student’s prior knowledge and includes demonstration. Most participants tell students about the mechanics of learning.

• **Processing** – The participant maintains a safe and engaging learning environment. Processing practices are usually social in nature and connect learning to real-life situations. These highly varied practices stimulate students on three levels: intellectual, emotional and somatic. Typically, movement occurs after 20 minutes.

• **Practice** – The participant creates opportunities for the student to practice the new material through activities such as role-plays and repeated presentations, thereby reinforcing learning by the end of the event. The presentation, processing and (sometimes) practice phases work in a cycle to reinforce learning.

• **Promotion** – The participant helps establish systems that will support the student by allowing additional processing and practice after the end of the event. Half of the participants actively propose the implementation of post-event promotion efforts; however, even they find it hard to convince clients to implement it.

**IQ3. Participant’s role in the classroom.**

The next set of interview questions addressed the role each participant saw themselves playing during the event.
• How would you describe your role in the training?
• Do you take on more than one role during the training?
• How do you choose which role to take on at which time?

There was no one label that participants used to describe the various roles they assumed during the course of an event. The role named most often was “facilitator” (P1, P3, P4, P5, and P6). However, participants even used this label in different ways. P5 and P6 described themselves as “facilitators of learning”, P1 as a “facilitator of the process”. P4 described her “facilitative role” only in the context of creating boundaries. P3 stated, “I’m a facilitator, but facilitator is kind of a worn out word.” The next most used labels were “demonstrator” (P1, P2, and P5) and “coach” (P3, P5). All other labels were cited by one individual participant, and included:

• P1: model
• P2: interpreter, master teacher, practitioner
• P3: illuminator, mediator
• P4: shadow consultant, convener, re-frame, shaman, speaker of the unspeakable
• P5: perceived expert, not the expert
• P6: the boss, guide on the side, not a friend.

Some participants described the role they assumed, rather than give it a label.

• P3: bringing in relevant distinctions, setting up the experience, managing the emotional climate within the session;
• P4: enabling the people in the room to share their deepest wisdom and deepest knowledge on the topic;
- P5: empowering others to be responsible for their own learning, delivering certain content, giving them an experience, supporting their sense making process.

Two things were clear regarding the labels participants gave to their roles: no one saw themselves assuming only one role when teaching adults, and they shifted their roles based on their assessment of what students needed in the moment. In considering the labels and descriptions that participants use to describe their role in the teaching process, the consistent underlying tone was to support students’ transition from their current state of understanding and skill to the next level (Table 27, p. 100). Although all participants describe themselves as delivering information during the Presentation phase, only half of them (P1, P2, and P5) cite this as a role. Often even this description is couched in caveats such as “My role is not to provide all of the information;” rather, “we facilitate their move from information to knowledge and understanding” (P1).

In support of the findings of the Processing phase, all participants identify as part of their role building on the prior experience of students, and most finding ways for students to apply new learning to real-life situations (P1, P2, P3, P5 and P6). In addition, half the participants (P3, P4, and P5) identify as a role the work they did to help students experience moments of discovery. As P4 explained,

I'm always happiest when I'm feeling that I am on the side and the participants have taken over the training in a way, are running it, and believe that the ideas and important breakthroughs are coming as a result of their work and not anything I've told them.
Surprisingly, even though all the participants describe specific philosophies held and actions taken to maintain a safe learning environment (Processing, p. 85), only two of them (P3, P4) identify this as a role.

<table>
<thead>
<tr>
<th>Table 27 Participant Functional Roles During the Event (IQ3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Help students go from one state of understanding to another</td>
</tr>
<tr>
<td><em>Build on what students know</em></td>
</tr>
<tr>
<td><em>Explore application to real life</em></td>
</tr>
<tr>
<td><em>Deliver information to students</em></td>
</tr>
<tr>
<td><em>Encourage discovery by students</em></td>
</tr>
<tr>
<td>Set and maintain boundaries</td>
</tr>
<tr>
<td><em>Create and maintain a safe environment</em></td>
</tr>
<tr>
<td><em>Be responsible for the agenda and time management</em></td>
</tr>
</tbody>
</table>

P1 and P6 described themselves as being responsible for the agenda and time keeping. P6 jokingly explained what she tells her university students,

I still direct the actions and the activities. They have to do what I say because I’m the boss; I tell them that anyway. I *am* the boss, after all. Part of that is because of lack of time; if I had more time, then I could sit back a little bit more. But, for the most part, we are really under the gun to get everything in. … So, I’m the boss.

**Conclusions from IQ3: Participant’s role in the Classroom**

The responses from the third set of questions in the interview focused on the participant’s role during an event. The label used most often was that of facilitator (5 participants), followed
by demonstrator (3) and coach (2). However, participants all described themselves as taking on multiple roles and the many other labels given were unique to the individual.

The responses also described the functions they performed. The consensus was that participants saw themselves as helping students transition to a different level of understanding. All of them felt their role was to build from the students’ life experience and current knowledge and most described themselves as helping students apply their new knowledge to real-life experiences. Interestingly, only half the participants cited as their role as providing information to students or encouraging discovery, and only four identified as a role that they were responsible for setting and maintaining boundaries during the event.

**IQ4. Additional teaching perspectives.**

The fourth set of interview questions addressed the participants’ perspectives on two additional issues regarding teaching: teaching in the moment versus staying with the agenda, and influences on long-term learning. The initial design of the interview included two other questions (“How do you deal with people’s physical state/needs during the training?” and “How do you deal with peoples emotional state/ needs during the training?”). Because of the nature of the responses, these were analyzed in earlier sections on Curriculum Development (p. 73) and Processing (p. 85). This section analyzes the responses to the other questions:

- How much of your training was based on what was happening in the room vs. the initial purpose of the training?
- Based on your experience, what most impacts long-term learning?
IQ4a. How much of your training was based on what was happening in the room vs. the initial purpose of the training?

The purpose of this question was to determine if the learner-focused approach of the participants would influence their tendency to stay with the original agenda or whether they would deviate from the agenda to address issues that arose in the classroom. Responses were mixed (Table 28).

<table>
<thead>
<tr>
<th>Table 28 Teaching in the Moment vs. Staying with the Agenda (IQ4a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usually goes with what is in the room</td>
</tr>
<tr>
<td>Usually stays with the agenda</td>
</tr>
<tr>
<td>Get agreement about going with the room</td>
</tr>
<tr>
<td>From the students</td>
</tr>
<tr>
<td>From management</td>
</tr>
</tbody>
</table>

P3 and P5 were more likely to go with what was going on in the room; “P2 and P4 were more likely to stay with the original agenda, feeling that their extra emphasis on pre-assessments allowed them to incorporate issues of difficulty into the curriculum. For P6, it depended on the type of event, staying closer to the original agenda during workshops than in a university class setting. Unfortunately, P1 was never asked this question directly. Most of the participants who responded to this question stressed the importance of getting agreement from students either during the preparation phase (P2, P4), or as the discussion began to veer from the agenda (P5). P3 lets management know beforehand the possibility of veering from the agenda during an event.

IQ4b. Based on your experience, what most impacts long-term learning?

When asked what factors most influenced long-term learning, responses were mixed but interrelated (Table 29, p. 103). With respect to long-term learning, P4 and P6 looked for key
factors to be present. P4 explained that long-term learning hinges on the commitment of the individual to continue to work with and apply the new knowledge. P6 believed that the key lies in the relevance of the material to the student. P2, P3 and P5 (Charts 3, 4 and 5 respectively, pg. 104) saw long-term learning as a process. P2’s process was the most complex and believed the learner goes through the steps of connecting with the material, experiencing a change, and then supporting the new learning. P5 looked for the first two steps to occur, while P3 looked for only the latter two steps. P1’s process (Chart 6, pg. 104) followed Bloom’s Taxonomy of the steps necessary for the student to process the material and come to discover relevance.

<table>
<thead>
<tr>
<th>Table 29 Greatest Influences on Long-Term Learning (IQ4b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learners go through a process that internalizes the learning</td>
</tr>
<tr>
<td>Key factors are present for long-term learning</td>
</tr>
<tr>
<td>Commitment of the student</td>
</tr>
<tr>
<td>Commitment of the organization</td>
</tr>
</tbody>
</table>

In addition, P2 and P4 considered important, but not always possible, getting the commitment on the part of the organization to support that continued learning. In some instances, “organizations recognize [the importance of] that, and integrate into their organizational systems opportunities for people to reconnect with the learning that they had and make continuous progress” (P4).

Conclusions from IQ4 a-b: Additional teaching perspectives

The responses from the fourth set of questions in the interview illustrated the participant’s perspectives on two additional issues regarding teaching: teaching in the moment versus staying with the agenda, and influences on long-term learning. Participants were divided
equally on the issue of whether they tend to stay with the original agenda designed for the event or whether they veer off the agenda based on students’ reactions and engagement levels. When it was necessary to go off topic, four participants recommended getting agreement beforehand from either students or management.

Four participants felt that students had a better chance of retaining new material if they went through a process. The most complex process required students to undergo three steps 1) connecting with the material 2) experiencing a conscious change and 3) practicing the new learning. Two participants looked for different combinations of two of the three steps. The last participant to follow a process led students through Bloom’s Taxonomy, which essentially completes step 1. The remaining two participants also felt that long-term learning could occur if students experienced one of the steps (elements of step 2 and step 3, respectively). Half the participants specified that the student had to be committed to wanting to learn; two participants indicated that the client organization needed to support the new learning on an on-going basis.

**IQ5. Participant focus of attention.**

The next series of questions asked participants to consider how their knowledge of brain research influences what they observe in the classroom (Table 30, p. 106).

- What things do you find yourself paying attention to? / Where is your focus?
- Does your preparation for the workshop include elements of what to observe?

**IQ5a. What things do you find yourself paying attention to? / Where is your focus?**

All participants relied on their student’s body language to inform them about individual and group energy levels. “I am constantly looking for visual or even auditory clues from my audience about what the climate is. … I’m really looking to see engagement and using that as
my key as to when I need to either omit something, jump ahead or insert something that maybe I hadn’t planned for” (P2).

P2 and P6 looked to facial expressions and body language to judge the student’s level of confusion or comprehension of the material. P4 also used these non-verbal cues to assess the level of trust in the room, the general pace at which the group was progressing, and the capacity of the group to “go deeper into issues or solution making.”

<table>
<thead>
<tr>
<th>Table 30 Participant Focus of Attention During an Event (IQ5a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body language</td>
</tr>
<tr>
<td><em>Engagement – energy/mood</em></td>
</tr>
<tr>
<td><em>Comprehension</em></td>
</tr>
<tr>
<td><em>Trust</em></td>
</tr>
<tr>
<td>Communication patterns</td>
</tr>
<tr>
<td>Environmental factors</td>
</tr>
</tbody>
</table>

Half the participants (P3, P4, and P5) also explained that they paid attention to the verbal portion of what happens in the room, to help them determine interpersonal dynamics and communication patterns among the group, as well as skill level. P1 and P2 also included that they paid attention to environmental factors like room temperature and extraneous sounds.

**IQ5b. Does your preparation for the workshop include elements of what to observe?**

All participants talked about using their experience and their intuitive sense to help them track and understand what was happening in the room. P4 however, took two additional steps in advance to help understand the group dynamics:
1) Sometimes I'll ask two or three people to be my eyes and ears if a discussion is going on that is considered fruitful for them to let me know through a signal system and if they think that the discussion has reached its level of fruitfulness.

2) My pre-training meditations. I really focus on trying to remove as many of my personal foibles and needs just to get out of the way as much as possible as a personality so that I'm not the one that people have to adapt to, but that really I'm an adaptive force and I'm modeling the way of how to adapt to others.

**Conclusions from IQ5 a-b: Participant focus of attention.**

The responses from the fifth set of questions in the interview focused the participant’s focus of attention when teaching. All participants indicated that they look at body language to determine the level of student engagement with the material. Half the participants also paid attention to verbal interactions in order to be aware of interpersonal dynamics and skill levels. Two participants were aware of room temperature and other environmental factors.

**IQ6. Personal impact of incorporating brain-based practices.**

The next series of questions considered the influence of neuroscientific findings on each participant, on a more personal level.

- How do you feel about incorporating brain research findings into your training?
- Which aspects of how adults’ learn are the most interesting to you?
- What differences do you see in your work as a trainer prior to becoming aware of brain research, and now?
IQ6a. How do you feel about incorporating brain research findings into your training?

All participants felt that neuroscientific findings validated their intuition and prior experience regarding good teaching practices, and kept them “on their toes” (P6). P1 explained, “The more I read, the more I understand why I do the things I do. And the more I read, the more I try things that I haven’t yet tried to see if they’ll work.” P1, P2 and P5 used terms such as “validating”, “affirming”, and “empowering.” Some of the responses to this question were deeply personal. P4 found the experience of working with neuroscientific findings “humbling,” for the more she learned, the more she was aware of how much she did not know. She also integrated the new knowledge into her interactions with family and friends. For P2, “That’s who I am and have been for 20 years so I couldn’t do it any other way.” P3 describes herself as “passionate about brain science”:

I feel like I’m on my mission. I feel like I’m empowering people to be more human and better people. I’m building a better world. It’s the deepest sense of personal satisfaction that I have when people get this stuff and implement it.

IQ6b. Which aspects of how adults’ learn are the most interesting to you?

The purpose of this question was to help gain a deeper understanding of participant motivation in incorporating brain research findings into their work. Unfortunately, two of the participants (P2 and P3) were not asked this question. The results for the other four (Table 31, p. 109) showed two primary fields of interest: the transformative nature of learning and the workings of the human brain. P1, P4 and P5 talked about their interest in helping people overcome self-imposed barriers to learning. In addition, P5 was interested in the moments of discovery that happen in learning, and the possibilities for influencing a persons’ value system.
and thus their behavior. P4 was drawn to the “wealth of knowledge” available from the students, as well as how to help them share it with each other.

<table>
<thead>
<tr>
<th>Table 31 Participant Interest in Adult Learning (IQ6b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transformation</td>
</tr>
<tr>
<td>Helping people overcome self-imposed barriers,</td>
</tr>
<tr>
<td>Other</td>
</tr>
<tr>
<td>How the brain works</td>
</tr>
<tr>
<td>Similar to kids</td>
</tr>
</tbody>
</table>

P1, P4, P5 and P6 were interested in the mechanics of how the brain worked. P1 and P6 found similarities to the working of children’s and adult’s brains. P4 and P6 were drawn to the somatic elements. P6 believed that “we are more kinesthetic learners than we think we are,” while P4 saw opportunities for improving the learning process as educators become more knowledgeable about the connection between what goes on in the body and what goes on in the head. P5 was interested in the process of memory and recall. P1 talked about the overlap between the workings of the brain and the practices being developed, “What I notice about my groups is how quickly they respond when you do the kinds of things that the brain research says need to be done.”

**IQ6c. What differences do you see in your work as a trainer prior to becoming aware of brain research, and now?**

All but one of the participants (P2) had experience as an educator before beginning to integrate the findings of cognitive brain research into their events. The interview questions focused on what changes the participants had seen in their own practices, before (Table 32, p.110) and after (Table 33, p. 111) the integration.
All five of the participants indicated that their presentation style had changed. P1, P4 and P6 had relied heavily if not completely on lecture. P5 had used practices that were not experiential and had not demonstrated what he wanted students to learn. P3 described her earlier role as that of a “performer”:

I would get a lot of positive feedback in training because people had enjoyed being there and hearing my stories and learning all kinds of “learning;” but, it’s learning about all kinds of interesting “concepts.” I used to walk out of the room and I would get these great smile sheets where everybody had given me 10s and I thought I did a really great training.

<table>
<thead>
<tr>
<th>Table 32 Participant Practices Before Integrating Brain-Related Research (IQ6c)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presentation Style</td>
</tr>
<tr>
<td>Used to lecture</td>
</tr>
<tr>
<td>Used to perform</td>
</tr>
<tr>
<td>Was less experiential</td>
</tr>
<tr>
<td>The relationship between student and teacher</td>
</tr>
<tr>
<td>Teacher was the source of knowledge</td>
</tr>
<tr>
<td>Students didn’t have much to contribute</td>
</tr>
</tbody>
</table>

Four of the five participants also noticed a change in the relationship with their students. Before incorporating brain-research-based practices, P1, P3, P4 and P6 saw themselves as the source of knowledge in the room. P1 described it in this story:

I thought my job was to go in and give them the benefit of my great knowledge. I was a sage on the stage, and my job was to just tell them everything about U.S.
history, or world cultures, or geography, and by gosh, they would just soak it in – and I’d say things like, “Does anyone have any questions?” Well, they didn’t, and I thought, I presumed, that that meant that they all understood. And they didn’t, of course.

P4 also saw herself “in charge of everything” and acknowledged that she minimized the importance of what students could bring to the learning process.

After their exposure to and adoption of brain-related practices, all five of the participants changed their presentation styles and their sense that the educator had to know it all. P3, P5 and P6 talked about the importance of creating an emotional experience to promote learning.

The emotional circuitry of the brain absolutely dwarfs the intellectual circuitry of the brain. As I’ve studied neuroscience, I have increasing respect for the role emotion plays in learning and the ability to work collaboratively. So, I pay attention to the emotional context at a much finer level than I ever did before – if I don’t pay attention to that, very little good learning is going to take place. (P3)

| Table 33 Participant Practices After Integrating Brain-Related Research (IQ6c) |
|---------------------------------|-----|
| Presentation style              | 5   |
| Creating an emotional experience | 3   |
| Grounding learning in somatic experience | 3   |
| Self-awareness                  | 5   |
| Content                         | 1   |

P1, P3 and P5 also promoted the importance of grounding people’s learning in their bodies, and made a distinction between intellectually knowing something and really knowing it
on a physical level. P5 gave an example of an exercise he employed to help people explore the distinctions between collaboration and competition and to discover “when does it make sense for me to be competitive; when does it make sense for me to be collaborative.” He first designed the exercise to be mostly discussion, but found that “It was too cerebral, and [students] were in their heads – some of them got it, but not others.” Then, “when I did the more physical and the body exercise, it was shorter, and it was in their bodies. They had a feeling of pushing one another in either a collaborative way or resisting someone’s push.”

All five participants who experienced such a “before and after” talked about increasing their levels of self-awareness as an educator: of how they did things, of the impact of their choices and practices, of their assumptions about learning and teaching, of what they defined as a successful event. P4 explained, “It's a continuous evolution.”

Conclusions from IQ6 a-c: Personal impact of incorporating brain-based practices.

The responses from the sixth set of questions in the interview focused the participant’s personal connections to teaching from the perspective of how the brain learns best. The first question in this section explored what it meant for the participants to be involved with this approach to teaching. All responses indicated that neuroscientific research seemed to validate their intuitive sense of what works in the classroom and that it inspired them to stay informed about successful teaching methodologies. Some participants felt this connection on a deeply personal level.

The four participants who responded to the question regarding what elements of adult learning they found most interesting focused on similar issues: the transformative nature of learning and the workings of the human brain. This is consistent with findings from the
responses on roles, as all participants ascribed to the function of helping students transition to a different level of understanding.

Participants were also asked to evaluate how their work as an educator had changed since they adopted practices designed with the brain in mind. For the five participants who had taught before integrating brain-friendly practices, the most frequently identified difference was in the way they presented information. Most of them described their earlier style as that of lecturer or performer, as well as the source of knowledge in the room. Since the changeover, participants felt that they were much more aware of their own process as an educator, and that they focused on the physical and emotional aspects of learning more than before.

IQ7. Additional information.

The last question asked participants if they would want to add anything before the end of the interview (Table 34).

- Is there anything else you want to share with me about integrating brain research into the way you approach your trainings / workshops?

<table>
<thead>
<tr>
<th>Table 34 Topics not Covered Earlier in the Interview (IQ7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reiteration of information shared earlier</td>
</tr>
<tr>
<td>Hopes for the future</td>
</tr>
<tr>
<td>Change in existing systems</td>
</tr>
<tr>
<td>Encourage life-long learning</td>
</tr>
<tr>
<td>Information on resources</td>
</tr>
<tr>
<td>Nothing to add</td>
</tr>
</tbody>
</table>

Many participants (P1, P2, P3 and P4) reiterated insights that they had shared earlier in the interview; P5 had nothing to add. In addition, most expressed hopes for the future. P1 and P2
wanted to encourage others to be life-long learners. P3 and P6 hoped for changes in existing systems. P3 explained,

> When people start to get that we’re operating out of a belief system [teaching from a rational perspective] that is fundamentally flawed, it opens up the possibility for a lot of behaviors that they don’t have permission for now. That is a really big and important piece around how great science can enable a different way of approaching work, training, life etc.

P6’s hope for change was centered in the academic realm and came from her frustration with what she feels is “the disconnect between our education establishment and the neuroscience research.” Her first wish was that administrators in schools from K through the university level would support instructor training and implementation of brain-friendly practices in the classroom. Her second wish was for more empirical evidence regarding the effectiveness of brain-based teaching practices. P4 longed for more resources on neuroscientific findings that provide information in a fun and accessible way.

**Conclusions from IQ7: Additional information.**

The five participants who wanted to add something at the end of the interview all expressed hopes for the future. Two of them focused on need for change in existing cultures in the corporate and academic worlds in order to increase their awareness and acceptance of brain-based practices. Two others encouraged life-long learning. The fifth, in support of her own life-long learning practices, hoped for additional sources of information regarding developments in neuroscience and its application to learning.
Conclusions about the interviews.

A review of the responses obtained throughout the interviews shows that participants have many points of similarity. The points for which there is the greatest level of variability are as follows; however, many of these points also had some points of commonality.

- **Type of Student** – The adults who attended the participant’s events came from many sectors: business, university, educators, management and parents of school age children. The only consistency was that all participants taught more than one type of student.

- **Length of the event** – Event length ranged from a couple of hours to multiple days. Some participants held classes. The only consistency was that all participant taught events of more than one length.

- **Repeat Audience** – Half of the participants taught new students every time; half held some events where they taught students they had worked with before.

- **Preferred Methodologies** – Each participant mixed a variety of different methodologies in developing their curriculum, based on their areas of interest. Some relied on specific methodologies; others chose from a variety of sources elements that fit their needs. The only consistency was that no one relied on only one methodology.

- **Teaching in the moment** - Participants were evenly split regarding their preference for staying with the agenda versus following issues that come up in the room.

- **Influences on long-term learning** – Because of the consistency found on so many of the approaches to teaching, it was surprising to find such varying opinions about what participants felt most influences long-term learning. Most of the
responses were some combination of relevance of material to the student, conscious change in the student’s perspective and the student’s commitment to continued learning. However, no two participants supported the same combination of those factors.

Participant perspectives and approaches showed a high level of consistency despite the differences outlined above, their varying levels of experience and their interests in diverse areas of learning and cognitive neuroscience. All of the participants taught soft skills and preferred to design and teach an event on their own. Most felt that student engagement was an indicator of success and so paid close attention to energy levels in the room throughout the event. All of them saw their function as building from a student’s existing knowledge base in order to help them gain new understanding and insights that could be applied to real-life situations.

The most consistent change in their approach to teaching after incorporating brain-related practice was an increased level of self-awareness about their own teaching practices. This awareness led to the abandonment of lecture and performance as presentation styles, the acceptance that they do not hold all the knowledge in the room and the incorporation of practices that create learning experiences on a somatic and emotional level to strengthen the learning done on an intellectual level. Out of the participant’s descriptions of the elements they include in an event also came a consistent approach to curriculum design and the event process, as outlined in Chart1 (p. 76) and Chart 2. (p. 96).
Discussion

The purpose of this study is to explore the impact of cognitive neuroscientific findings on the work of educators who teach adults. The Introduction (p. 6) posed two questions:

- To what extent does the interpretation of cognitive neuroscience research affirm or disaffirm what teachers of adults are already doing?
- How have interpretations of neuroscientific findings changed the way educators teach adults?

To help understand what “teachers of adults are already doing,” the review of the literature first examined the major adult learning theories and their practices (p. 8). Then the Literature Review explored the interpretations of neuroscience developed by scientists, psychologists and educators for use in teaching adults. The Results section (p. 55) explored how six educators had implemented interpretations of neuroscientific findings into their work. In this section, we will summarize the findings from the Results section, including the answer to the second question above. Then, we will explore how the Results findings differ from what was found in the Literature Review and address the first question above.

Patterns in the Interviews and Surveys

The interviews and surveys provided individual perspectives on what it meant for educators to implement neuroscientific findings into their work. The survey portion gathered information regarding each participant’s background in using brain-friendly practices; their source of neuroscientific information; the level to which they interpreted research; and the level to which they integrated both adult learning theory and brain-friendly approaches into their work. The interview focused on the participant’s experience of teaching: what elements they chose to include in curriculum design; what they saw as their role; how they worked with the emotional
and physical aspects of learning; what they paid attention to in the classroom; how they measured success; and what it meant to them personally to be integrating brain-friendly practices into their work.

**Background of the participants.**

Information on the participants and their background was gathered from responses to both interview and survey questions. In order to provide a foundation for understanding each participant’s perspective, information was gathered regarding their experience with adult learning theory and neuroscientific interpretations, the general characteristics of the event they lead, as well as their curriculum design preferences.

**Experience with adult learning theory and neuroscientific interpretations.**

The four women and two men who participated in the study had substantial experience (5-25 years) utilizing brain-friendly practices and were knowledgeable about both adult learning theory and neuroscientific interpretations. There was an equal split among them as to which methodology they relied on the most; however, they all saw both fields as contributing to their work with learners. Five of the participants were able to provide examples of the changes in their teaching methods before and after the implementation of brain-friendly practices.

**Event characteristics.**

The participants all taught soft skills (communication, conflict resolution, team building, and teaching) to a wide range of students (corporate employees, educators, university students, managers, administrators and parents). They also taught in a variety of formats from a series of classes to workshops ranging in length from less than a half-day to multiple-days. Half the participants who taught in a workshop format worked only with people they had never taught
before. Half the participants taught both in class and workshop format. All participants taught more than one type of student, more than one subject and used more than one type of format.

**Curriculum design.**

All but one tended to design and present curriculum on their own; the other prefers to collaborate with others. The two participants who taught K-12 teachers often incorporated the work of brain-based interpreters such as Caine & Caine, Jensen, and Allen – these authors originally interpreted for children and then expanded their work to adult learners. One of the participants who worked in a university setting preferred to integrate Accelerated Learning practices (Meier, Rose) – a brain-friendly approach more prevalent in corporate and university settings. However, each participant combined a variety of interpretations and practices when developing curriculum, based on their own experience and values as well as the needs of the group being taught. Each participant regularly researched new approaches for the classroom, tried them out and kept what worked; it was clear that all the participants valued life-long learning. In addition to incorporating adult learning theory and brain-friendly interpretations into their curriculum, two thirds of the participants integrated practices from other disciplines (Appreciative Inquiry, linguistics, Neuro-Linguistic Programming, Psych K, Shamanism, Tribes, and an additional un-named source), and half from other fields of neuroscientific study (altruism, creative thinking, skill encoding, and multiple intelligence).

**Event design preferences.**

Participants provided information about their curriculum design preferences throughout their interviews. When analyzed, the responses showed both a striking level of commonality and individuality in the design of event curriculum.
Common patterns.

Participants were never asked directly if they incorporated any particular structure to the design of an event; rather interview questions focused on the brain-friendly elements and methodologies that participants chose to include in curriculum design. Only two participants specifically talked about building their curriculum around a specific structure; however, each used different methodologies as a base. In addition, responses from participants showed high levels of variability regarding their student types, formats, and preferred underlying methodologies. Nevertheless, analysis of the responses showed a strong consistency in the process that participants followed when holding an event.

Analysis of the interview data indicates that events have five distinct phases: Preparation, Presentation, Processing, Practice, and Promotion (See Charts 1 and 2 pgs. 76 and 96). The Preparation phase starts before the event and includes the introductory portion of the event. Presentation, Processing and Practice follow as a cycle to introduce new material, integrate it with a student’s existing knowledge and empower the embodiment of the learning. All participants describe activities in the first three phases; five participants give examples of Practice and all participants include elements of the Promotion phase. This last phase encompasses the closing portion of an event, as well as any work done after the event (whenever possible). Half the group actively attempts to create possibilities for students to practice after an event, with mixed success.

Individual expression.

Although the phases of the event are consistent across all participants, many other factors are not. What each participant chooses to include in their curriculum and what they emphasize during the event reflects their values, interests and experiences; as well as those of the learners in
attendance – making each event unique. In the over six hours of interviews, there were very few overlaps in specific exercises, activities and stories described by participants, even though they all taught soft skills. When asked to identify the roles they took on during an event, participants came up with highly individualized responses which included eight different descriptions and nineteen distinct descriptors with only one major overlap among them, “facilitator.” Even then, the five participants each used the term “facilitator” in a different context. Responses to whether a participant preferred to stay with the planned agenda or teach in the moment were equally divided, and seemed to be based more on personal preference than on learning theory or brain-friendly approaches. When asked which elements of adult learning theory and learning-related brain research most influenced their work, respondents listed twenty-one different elements; the greatest agreement on any element was the three participants who listed the “impact of stress on learners.” All of these factors confirmed the highly individual nature of event design and implementation, despite the consistency in structure.

Participants also differed on what they considered effective ways to promote long-term learning: four thought it was the result of a process, and two considered essential the presence of key factors. However, no two participants gave the same answer to this seemingly critical question. Five participants agreed one measure of success factor: the level of engagement of the student during the event.

**Influence of neuroscientific findings on teaching.**

During the interview, participants shared what it meant for them personally to be working with brain-friendly practices. In addition, participants were asked about the differences they perceived in their approach to teaching since they began integrating brain-friendly practices.
Responses to this question also provided insight into one of the main questions posed in the Introduction (p. 6).

**Personal impact of neuroscientific research.**

All participants were enthusiastic and a couple even passionate about the use of neuroscientific findings in teaching. This was reflected in their commitment to continued personal education, including reading, attending conferences, belonging to communities of practice, and observing other trainers.

**How have interpretations of neuroscientific findings changed the way educators teach adults?**

Of the five participants who had taught before knowing about cognitive neuroscientific research, the most definitive influence of this research was an increase in awareness of their own teaching practices. All of them indicated that the new information led them to change their presentation style away from lecture or performance. Four of them also shifted their perspective regarding the learner-teacher relationship, and accepted that the teacher was not the source of all knowledge. Two participants explained that they now focus more on the emotional and physical aspects of learning; a third increased their focus just on the emotional and a fourth just on the physical.

**Commentary on the Results findings.**

As an educator of adults, I became inspired listening to the participants share their experiences. Their enthusiasm for their work, their interest in continued learning, as well as the obvious joy they derived from working in the field was contagious. I got a sense from the interviews that the neuroscientific findings had provided a focus for their intentions when
working with adult learners – helping them stay focused on the elements essential to adult learning.

I found surprising the answers participants gave regarding the perceived differences in their approach to teaching since they began integrating brain-friendly practices. The top answers, the move away from a lecture format and the relinquishment of their responsibility as the expert, are common practices in many adult learning models. As all the participants consider themselves well versed in adult learning theories, this set of responses had me puzzled for a while. I finally surmised that perhaps the neuroscientific perspective on learning acted as a motivating force for their personal and professional continuous improvement in a way that other perspectives on learning had not.

Because of this realization, I believe that the answer to the question, “How have interpretations of neuroscientific findings changed the way educators teach adults?” should be expanded upon. For some educators, the interpretations of neuroscientific findings have become a motivational force helping them become more aware of the way that they teach, the way students learn, and what tools they can incorporate to be the best educator they can be. Whether the attraction to the findings is due to the credibility lent by the scientific nature of the research, the empirical success of the practices in the classroom, or inherent excitement generated from exposure to new ideas, the enthusiasm and motivation for improvement are real and have a real impact on both the educators and the learners.

Comparison of Practices Based on Adult Learning Theory and Brain-Friendly Findings

As stated in the Introduction, learning is integral to who we are as human beings. People learn formally and informally. Successful teaching practices are developed through trial and error and through research, as well as a combination of both. It is impossible to consider brain-
friendly practices as separate and independent from those developed as a result of adult learning theories. It is not surprising then, that there is overlap in the practices generated by the approaches founded on cognitive psychology and cognitive neuroscience. The following sections compare and contrast each adult learning theory to brain-friendly practices.

**Behaviorism.**

There are fundamental differences between the interpretations of cognitive neuroscience and the perspective of Behaviorism when it comes to the roles of learners and teachers, as well as what constitutes learning. Behaviorism sees the teacher as the source of knowledge who determines what will be learned and how, and then organizes external factors to support the development of specific skills or behavior modifications in the learner. Working from this perspective, relevance of the material to the learner and the emotional connection to learning are minimized. Brain-friendly practices see the teacher and learner as partners in the learning process, actively collaborating to create an environment and process that supports learning at a mind-body level.

Despite these differences, both approaches consider certain practices as essential to learning. Behaviorists believe in establishing a process of observation and imitation, supported by repeated guided practice and feedback. Brain-friendly educators recognize and adopt this approach as a way to support the work of mirror neurons and the strengthening of the new neural paths generated by learning. In addition, each use memory aids such as mnemonics and, to a degree, external motivators. However, the reasons for the use of external motivators is quite different: Behaviorists utilize external motivators to ensure that students are learning correctly (given the standards set by the teacher), whereas brain-friendly educators use external motivators
to engage the learner and create more complex connections with the learning. Both approaches also agree that the learning environment should be relatively free of stress.

**Cognitivism.**

This section explores cognitivism out of its usual order (as presented in this study) because of the parallels to behaviorist practices. In addition to the similarities to brain-friendly practices related to behavior modification, cognitivism also incorporates problem-solving, critical thinking, modeling, and other cognitive approaches to learning.

Another difference between brain-friendly and cognitivist practices is the relationship between the teacher and the learner. As in behaviorism, the cognitivist teacher is responsible for the learning process and the assessment of the learner’s progress. As a result, practices that promote self-directed learning or active participation in the design of the learning process are not utilized.

**Humanism.**

There are many parallels between the humanist and brain-friendly approach to learning: empowering the learner to be responsible for their own learning, incorporating self-directed work, enabling exploration and discovery, ensuring a safe and supportive environment and using external motivators. Both approaches also recognize and respect that each learner is on their own path to learning and so create situations where learners can learn in the way that is best for them; in addition, both invite the learner to help create the learning process. Each recognizes emotions as a critical part of learning.

The biggest differences between the two approaches are in the goal of the learning process and the role of the material taught. The goal of a humanist education is the self-actualization of the learner. As such, the content and the exercises are part of the process of
helping each individual become the best they can be. Brain-based educators are there to teach material and skills; helping the learner be self-aware and self-directed are some of the best ways to accomplish that goal.

The other significant difference is the importance of the mind-body link. Humanism recognizes that the body plays a role on the path to self-actualization, and that a person cannot progress along that path if they have not fulfilled basic physical needs such as hunger, thirst, rest, or general health. However, brain-friendly educators take the mind-body connection much deeper and recognize that self-actualization happens on a physical level as well as on psychological and spiritual levels and as such, practices integrate the physical aspects of learning.

**Constructivism.**

Constructivism and brain-friendly educators share similar practices in a variety of areas. Both engage the learner using hands-on exercises that focus on real-life tasks. Both recognize that each learner has their own process and that they are responsible for their own learning and progress and so utilize practices that encourage active participation and self-assessment. Both encourage the learner to take in information from all their senses, observe, reflect, and tie new learning to prior experience.

A couple of the differences in practices center on the role of emotion and the role of other students. Constructivism’s view of the learner’s building knowledge is primarily an individual cognitive process. Sometimes emotions are recognized in understanding the mental model the learner has constructed about how things work, but this tends to be more of an intellectual recognition of their role. Nevertheless, constructivist educators specifically utilize experiential and inquiry-based practices because they build learner engagement and enthusiasm. Learners do learn in a group setting, but not actively from each other.
Andragogy, Social Cognitive, Transformational and Experiential Learning.

In considering the practices used in the classroom, there are many parallels between the exercises and tools used by brain-friendly educators and those who teach from the perspectives of andragogy, social cognitive, transformational and experiential learning. Each of these approaches emphasizes a combination of realistic problem solving which builds on prior experience. Each recognizes the benefits of shared learning experiences and places the educator in the role of facilitator. Each encourages self-reflection and self-direction on the part of the learner. Each explores the relevance of the material to the learner as well as future applications of what is learned.

The differences between the adult learning theory and brain-friendly methodologies lies more in the level of importance given to the impact of learning on the body. As a result, developers of brain-friendly practices give more examples of how to stimulate the senses, reduce stress levels in the body, take regular breaks, keep hydrated, build more complex connections with the material, etc. This is not to say that educators working with adult learning theory methodologies do not address these issues in their classrooms – years of experience working with adult learners could bring them to the same conclusions. However, these practices are not emphasized in the literature.

Comparison of Literature Review Findings with Interview and Survey Results

The comparison of the Literature Review findings to the Results findings provides the answer to the first question posed in the Introduction, “To what extent does the interpretation of cognitive neuroscience research affirm or disaffirm what teachers of adults are already doing?”
General overlap.

If you consider the elements identified by the participants in general terms, each of them is addressed in one or more of the adult learning theories. Table 35 (p. 129) shows a list of each curriculum element identified by the participants, one example of an adult learning theory that supports the use of that element, and one example of a neuroscientific interpretation that also supports the use of that element. Although more adult learning theories and neuroscientific interpretations could support the use of any particular element, for the purpose of this study, one example was considered sufficient to show a connection. The only element not included below is “Keep up with Developments in the Field.” The table shows that each curriculum element identified by the participants is expressed in both adult learning theory and cognitive neuroscience.

This finding confirms that elements of various adult leaning theories which have been successfully discovered through observation and interpolation are reflected in the interpretations of neuroscientific research recommended as best practices. Brain-friendly interpreters Byrnes (2002), Zull (2006) and Jensen (2008a), support this finding and strongly encourage educators to look to both cognitive psychology and cognitive neuroscience. Participants in this study also stated that neuroscientific findings affirm the work they do with adults (P1, P2, and P5), and that they see other successful educators and leaders do as well:

When people hear more and more about the brain, many times it’s affirming and acknowledging what they’ve been doing intuitively. So, the great teacher or the great leader has been using strategies, then they hear that’s how the brain learns best; then it acknowledges what they’ve been doing. (P2)
<table>
<thead>
<tr>
<th>Table 35 Comparing Participant Event Elements with Adult Learning Theory and Neuroscientific Research Descriptions from the Literature Review</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Elements</strong></td>
</tr>
<tr>
<td><strong>Preparation</strong></td>
</tr>
<tr>
<td>Conduct pre-assessments</td>
</tr>
<tr>
<td>Design Curriculum</td>
</tr>
<tr>
<td>Address Student’s physical needs</td>
</tr>
<tr>
<td>Address Learner’s emotional needs</td>
</tr>
<tr>
<td><strong>Presentation</strong></td>
</tr>
<tr>
<td>Keep presentation time short</td>
</tr>
<tr>
<td>Follow presentation with processing</td>
</tr>
<tr>
<td>Build on prior knowledge</td>
</tr>
<tr>
<td>Demonstrate material to be learned</td>
</tr>
<tr>
<td>Be explicit about the learning process</td>
</tr>
<tr>
<td>Elements</td>
</tr>
<tr>
<td>----------------------------------</td>
</tr>
<tr>
<td>Vary approaches</td>
</tr>
<tr>
<td>Maintain a safe environment</td>
</tr>
<tr>
<td>Incorporate social interaction</td>
</tr>
<tr>
<td>Encourage connections to real-life</td>
</tr>
<tr>
<td>Incorporate somatic learning</td>
</tr>
<tr>
<td>Make emotional connections</td>
</tr>
<tr>
<td>Elements</td>
</tr>
<tr>
<td>------------------</td>
</tr>
<tr>
<td>Practice</td>
</tr>
<tr>
<td>Promotion</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
Although each element was supported by at least one learning theory, the overall approach taken by brain-friendly educators was closest to that of educators using more student-centered approaches such as those found in experiential learning, as well as transformational learning, andragogy and social cognitive.

More commonalities between adult learning theories and neuroscience were found in the area of research. Byrnes (2001) studied the overlap between psychological research and brain research on the issues of brain plasticity; attention; threats and stress; and memory. He found that researchers from both disciplines were building on other’s work and testing out each other’s findings.

**Specific differences.**

Considering the elements in general terms shows us that research on learning done by studying and interpreting behavior has a lot in common with research on learning done by studying the brain. However, it is in the specifics of research on emotions and classroom practices where bigger differences can be found.

**Research.**

Byrnes (2001) found that neuroscientific research on emotion focused on understanding the workings of specific emotions such as anger and fear, rather than building on the models already developed by psychologists on understanding differences between emotions.

**Limitations of theoretical perspectives.**

Each of the adult learning theories started with a particular perspective from which to address the learning process: behaviorist focused on what could be observed, cognitivists explored an alternative to the limitations of the behaviorist approach, social cognitivists considered the social implications of learning, etc. As a result, the theories forgo the benefits of
other perspectives and the richness of the experience of teaching from another perspective in order to address the issues inherent in their chosen construct. Interpretations of cognitive neuroscientific findings can help educators work across theoretical boundaries to select best practices from each theoretical perspective. As it has been over the ages, the key will be the results of the implementation of these practices in the classroom.

*Classroom practices.*

The biggest difference between the adult learning theory and the brain-friendly methodologies is in the implementation of the classroom practices, especially with regard to the physical and emotional aspects of learning. Student-centered and brain-friendly practices each place great emphasis on creating activities and simulations designed to allow the learner to experience, in a physical way, new learning in realistic conditions. However, to interpreters of neuroscientific findings and the participants in this study, the concept of embodied learning goes beyond experiential learning.

Of particular importance to the participants was the conscious awareness of the importance of movement because of its ties to learning centers and memory formation. One third of the participants specifically named the use of movement as a measure of success for their event. Three participants made sure that learners in their class moved about every 20 minutes, a fourth made sure they moved every 30–45 minutes, and a fifth stated, “I think we are more kinesthetic learners than we think we are” (P6).

In addition, participants focused on other physical aspects of learning such as sensory stimulation, attention generation, somatic awareness of emotional reactions, kinesthetic stress reduction, actions to enhance group integration and socialization, etc. Another important
physical element is the learning that comes through observation, because of the work of mirror neurons. Five of the participants listed demonstration as a key element of their presentation.

As with the physical aspects, the emotional aspects of learning were also a critical aspect of the participants’ work, both in the planning process and in the classroom. Creating an emotional climate conducive to learning went beyond creating a safe environment; all the participants actively planned, monitored and managed the mood and tone of the room. In addition, five out of the six named student engagement as a measure a successful event.

**Commentary on the comparison between the Literature Review and the Results findings.**

Although the participants had made it clear that they relied on both adult learning theories and interpretations of cognitive neuroscience, I was intrigued that all the elements they included in the design of an event had roots in both methodologies. I also did not expect such a level of consistency in the event designs, given the range of participants’ individual preferences and fields of interest, as well as the differences in their event’s length, type, subject matter, and audience.

The importance that the first three participants interviewed placed on the timing of curriculum elements surprised me, and I had to add a question to my later interviews to make sure to cover the topic consistently. The results were enlightening: keep the presentation short meant 5 – 20 minutes, let them process the information for varying lengths of time meant 1 – 45 minutes, practice generally lasted 15 -20 minutes, and people should move around every 10 – 45 minutes.

I did not expect each participant to have a different perspective on what influenced long-term learning. Although half of the participants listed what happened after the event as a factor
of success, only P3 included the establishment of practice opportunities after the event as both an important part of long-term learning and a measure of event success. My original assumption was that trying to achieve long-term learning would have been a factor in event design; yet, the designs were consistent despite the participant’s different understanding of what would help learners retain new learning. The fact that each participant had a different perspective on this aspect of learning is perhaps more an indicator of the lack of long-term access to the learners inherent in educational structures. Although participants are regularly trying out new approaches to determine what works best in a classroom setting, they do not have consistent access to students on a long-term basis, and so cannot verify as easily the impact of their practices on long-term learning.
Summary and Recommendations

The purpose of this study was to consider the influence of cognitive neuroscientific findings on the way educators of adults think about their work, approach the development of curriculum and interact with their students. The study addressed two questions of interest:

- To what extent does the interpretation of cognitive neuroscience research affirm or disaffirm what teachers of adults are already doing?
- How have interpretations of neuroscientific findings changed the way educators teach adults?

In order to answer these questions, the study first explored how learning had been described in seven major adult learning theories. Interpretations of cognitive neuroscientific findings regarding learning were also reviewed. The final source of information came from surveys and interviews of six participants, all experienced educators with over five years of experience of integrating brain-friendly practices into their work with adults.

Parallels between Adult Learning Theories and the Interpretations of Cognitive Neuroscience

The study showed that the interpretations of brain research affirm and support the work that educators of adults have been doing based on various elements of adult learning theories. The results indicate that there are especially strong parallels to student-centered adult learning theories such as experiential learning, as well as transformational learning, social cognitive, humanist and andragogy with regards the role of the learner and teacher, as well as the importance of emotion and the body in learning. In addition, there are strong parallels to behaviorist theory with regard to the importance of repetition and the creation of a stress-free learning environment. Also strongly advocated by all the theories is the importance of
incorporating a learner’s prior experience into the adult learning process. In his article, *Key Aspects of How the Brain Learns* (2006, p. 8), Zull supports this finding:

> These ideas [brain-friendly practices] are not necessarily new and are consistent with many of the concepts of adult learning developed by others (see Knowles, Holten & Swanson, 2005). However, it is still of great importance to identify where neuroscience is taking us and to examine how it fits with current concepts and theories of adult learning. Ultimately, our understanding of learning must be consistent with the biological properties of the learning organ. In fact, no matter how widely accepted they may be, all current theories will automatically be reconsidered and revisited as our knowledge about the brain continues to grow.

In addition, the study indicates that neuroscientific findings promote an even greater, more explicit inclusion of practices and approaches that support the physical aspects of learning, as well as the all-important body-mind-emotion connections needed in learning.

**Discovery of a Consistent Model for Event Structure**

An unexpected but pleasant result of this study was the discovery of a consistent model to describe the teaching process during an event (See Charts 1 and 2 pgs.76 and 96). This model reflects the process used by educators influenced by both adult learning theories and interpretations of cognitive neuroscience.

The model outlines a five-step process of Preparation, Presentation, Processing, Practice and Promotion that covers elements that occur before, during and after an event. There is also consistency in the elements that make up each phase:

**Preparation**

- Keep up with developments in the field
• Assess student preferences, objectives, practices and/or relationships

• Prepare curriculum

• Address student’s physical needs before presentation

• Address emotional needs before presentation

Presentation

• Keep it short

• Follow immediately with processing

• Build on prior knowledge

• Demonstrate or model new material

• Be explicit about the learning process

Processing

• Maintain a safe yet engaged environment

• Incorporate social interaction

• Make connections to real life experiences

• Incorporate somatic learning

• Incorporate emotional connections

• Vary ways in which people process information

Practice

• Incorporate opportunities to practice new learning

Promotion

• Bring the event to a close

• Integrate opportunities to practice after the end of the event
Although the study found strong consistencies in the way participants structured events, it also found that each event was a unique expression of the personality, interests and values of each participant, as well as a reflection of the needs of their students.

**Recommendations**

It would be beneficial to introduce brain-friendly research and practices to educators of adults for a variety of reasons:

- Brain-friendly methodologies provide educators with a different perspective on learning and teaching and thus an opportunity to reflect on their own practices.
- The motivational influence that cognitive neuroscience had on the participants of this study was contagious and should not be underestimated.
- Interpretations of cognitive neuroscience have inspired the development of practices that provide more tools to educators looking to increase the level of somatic learning in their curriculum.

**Future study.**

Few studies attempt to measure the effectiveness of any learning methodology, whether the methodology is based on psychology or neuroscience. It is my hope that more of this type of research will be encouraged and conducted in the future.

Another possible direction for future study would be to compare the model generated from the study to the models describing experiential, brain-based and accelerated learning methodologies to explore the parallels and differences.

This study also exposed a mystery that could be further explored regarding long-term learning. Although the participants followed a similar structure when teaching adults, they gave varied explanations of the processes or factors essential for long-term learning. Further study
could explore in greater depth the different theories and findings regarding long-term learning, address the lack of consistency among educators in their understanding of this seemingly critical adult learning issue, and provide educators guidance by studying the impact of various practices on long-term learning.
References


presented at the Academy of Human Resource Development International Conference (AHRD) (Austin, TX, March 3-7, 2004) p1067-1074 (Symp. 49-2).


McCandliss, B. (n.d.). *Brain-Based Education - Summary Principles of Brain-Based Research, Critiques of Brain-Based Education*. Retrieved 10/24/08 from http://education.stateuniversity.com/pages/1799/Brain-Based-Education.html


Appendix A

Sample e-mail invitation to identified participants

SUBJ: Master Thesis

I wanted to contact you about a project that I am working on to see if you might be interested in working with me.

I'm currently working on my Masters thesis at JFK University on how trainers incorporate neuroscientific findings in the ways they teach adults. As part of my thesis, I'm interviewing teachers of adults who utilize have used teaching methods which incorporate neuroscientific findings for at least two years. My work focuses on the teacher's subjective experience - how the knowledge from the neuroscience has influenced curriculum design, their role in the classroom and their perspectives on a variety of classroom related issues.

If you would be interested in helping me with this project, it would be a three part process: a consent form that talks about the project and confidentiality issues; a short survey (no more than 15 minutes, mostly rating questions with a few short answer questions); and a later phone interview (45 - 60 minutes long that gives us a chance to talk about your experience of working with these techniques in the classroom).

I hope that this is something that you would consider helping me with. It's been enlightening to see how different people approach the integration of brain-based methods, and I'd be happy to share the summary of my findings as well as my final thesis with you, if you would find it interesting.

Please let me know if this is something that might appeal to you. I'd be happy to answer any questions you might have about the project by e-mail, or I could call you at your convenience.

Thanks for considering it,

Elizabeth
Appendix B

Informed Consent Form

My name is Elizabeth Maggio. I am currently a graduate student in the Masters of Organizational Psychology program at John F. Kennedy University in Pleasant Hill, California. The research project is a requirement toward the completion of my Master’s degree. This research project is being conducted under the advisement of Sharon Mulgrew, M.P.H. – Organizational Psychology Research Coordinator. She can be reached at SAMulgrew@aol.com or 510-450-0378.

Project Summary: The proposed study will focus how knowledge from the study of the brain has impacted the trainer's curriculum design, role and perspectives. The study will be conducted through a combination of 1) a preliminary survey and 2) an individual interview with educators of adults. The survey is expected to take approximately 10 - 15 minutes and consists of rating statements regarding the educator’s preferences and practices, as well as four questions which ask for a short answer. Each interview is expected to be of 45-60 minute duration and will be tape-recorded. Study participants will be asked to describe their own experience as an educator/teacher/trainer and how the knowledge of neuroscientific research on adult learning impacts their approach to teaching. Data gathered in interviews will be analyzed and interpreted with the goal of enabling a more complete understanding of how knowledge of neuroscientific research on adult learning impacts educators/teachers/trainers of adults. You may also be contacted by phone at a later date for clarification or follow-up necessary to insure accuracy of the data.

Voluntary Participation: Participation is completely voluntary and participants are free to change their mind at any time and choose not to continue even after signing this consent form.

Confidentiality and Anonymity: All information given by study participants is confidential and individual contributions are anonymous. All data will be stored in a secured, confidential location accessible only by me as well as a third-party subscriber. Each participant will be identified on the tape by first name and participant code only.

Availability of Results: A Summary of the results of this study will be available to participants upon request after completion of the study.
Consent: I hereby consent to participate in the above research project. I understand that my participation is voluntary and that I may change my mind or refuse to participate or withdraw at any time without consequence. I may refuse to answer any questions or I may stop the interview. I understand that some of the things I say may be directly quoted in the text of the final report, and subsequent publications, but that my name will not be associated with this study.

Participant Signature: ___________________________ Date: _________________
Name: (Please Print) __________________________________

Witness Signature: ___________________________ Date: _________________
Name: (Please Print) __________________________________
Appendix C

Preliminary Survey

Before our interview, it will be helpful for us to understand your approach to working with adult learners.

We understand that each trainer has found their own combination of what makes them successful at what they do. Your answers will help us better understand your approach and will allow us to focus our interview time on your experience during training events.

1) Experience in working with adults
   a. How many years you have been teaching adult learners? _____
   b. How many of those years have you been using practices based on brain research? _____

2) Factors that impact work with adults
   Please rate (on a scale of 1 – 5) the level to which the following sources impact your work you do now with adult learners (1 = does not have much of an impact, 5 = has a great impact):
   • In-classroom observation – seeing how my students interact with the material and presentation (1-5) ______
   • In-classroom experience – trying new approaches in the classroom (1-5) ______
   • Feedback – evaluations and comments about your trainings from students and other trainers (1-5) ______
   • Observation – observing other trainers and their techniques (1-5) ______
   • Training publications – reading popular, academic or professional literature on training (1-5) ______
   • Education – attending workshops or conferences that support your work as a trainer (1-5) ______
   • Psychology or Education literature – reading popular, academic or professional literature on adult learning from the fields of psychology or education (1-5) ______
• Neuroscience literature – reading popular, academic or professional literature on adult learning from the fields of biology or neuroscience (1-5) _____

• Please let us know what other sources have impacted your work: _______________________________________

• If you had to choose your top two sources of knowledge from the list above, what would they be?
  a) _____
  b) _____

For questions 3), 4), 6) and 7) below please indicate the level (from 0 to 10) that appropriately describes you:

3) In describing my level of knowledge of psychological theories of adult learning, I would say

4) In describing the level to which I incorporate adult-learning theory into my work as a trainer, I would say

5) Please let us know what element(s) of adult learning theory you feel most impact(s) your work.

6) In describing my level of knowledge of learning-related brain research, I would say
7) In describing the level to which I incorporate learning-related brain research into my work as a trainer, I would say

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>I don't knowingly incorporate brain research</td>
<td>I actively incorporate brain research</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8) Please let us know what element(s) of learning-related brain research you feel most impact(s) your work.

9) Implementation vs. Interpretation

a. Please rate (on a scale of 1 – 5) the level to which the following statements are an accurate reflection of how you use neuroscientific research in your work (1 = not accurate, 5 = very accurate):

- I consider myself an interpreter of neuroscientific findings – I read the scientific research and determine how it can be used to better teach adults. (1-5) _____
- I use my interpretations of neuroscientific findings and create applications and techniques that can be used in the classroom to better teach adults. (1-5) _____
- I use the other people’s interpretations of neuroscientific findings and create applications and techniques that can be used in the classroom to better teach adults. (1-5) _____
- I use the applications and techniques that I have developed when I teach adults. (1-5) _____
- I use other people’s applications and techniques when I teach adults. (1-5) _____

b. If these statements do not appropriately reflect how you use the findings from brain research regarding adult learning, please let us know how you use this research in your work:
Appendix D

Interview Questions

1. Think about a successful training which you led in which you used your knowledge about how the brain learns. Tell me a little about the training.
   a. What was the training about?
   b. Did you work with a co-trainer?
   c. Did you design the training?
   d. Had you worked with this group of learners before?
   e. What made it a successful training for you?

2. I would like to address the elements that you integrated into the development or editing of the training curriculum that you specifically included because of how you think the brain learns best.
   a. What elements did you include in your curriculum that were specifically designed to address how the brain learns best?
   b. Do you follow one specific approach / methodology (Jensen, Caine & Caine, Accelerated Learning, etc.)?
   c. What kind of advanced planning did you do?
   d. Can you give me some specific examples?

3. I would like to address what you saw as your role when you led the training.
   a. How would you describe your role in the training?
   b. How do you prepare for that role?
   c. Do you take on more than one role during the training?
   d. How do you choose which role to take on at which time?
4. I would like to address your interaction with the students during the training.
   a. Do you deal with people’s physical state / needs during the training? If, yes, how?
      • Can you give me an example?
   b. Do you deal with people’s emotional state / needs during the training? If, yes, how?
      • Can you give me an example?
   c. How much of your training was based on what was happening in the room vs. the initial purpose of the training?
   d. Based on your experience, what most impacts long-term learning?

5. I would like to address what you pay attention to when you are leading a training.
   a. What things do you find yourself paying attention to? / Where is your focus?
   b. Does your preparation for the workshop include elements of what to observe?

6. I would like to address what your personal connection to working with neuroscientific findings in your work.
   a. How do you feel about incorporating brain research findings into your training?
   b. Which aspects of how adults’ learn are the most interesting to you?
   c. What differences do you see in your work as a trainer prior to becoming aware of brain research, and now?

7. Is there anything else you want to share with me about integrating brain research into the way you approach your trainings / workshops?