

EFFECTS OF USING A NEUROEDUCATIONAL INTERVENTION TO ENHANCE  
PERSEVERANCE FOR ONLINE EDD AND EDS STUDENTS

by

Charles R. Cadle

Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

Doctor of Education

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APPROVED BY:

Amanda Rockinson-Szapkiw, EdD, Committee Chair

David E. Holder, PhD, Committee Member

Jan Richards, EdD, Committee Member

Scott B. Watson, PhD, Associate Dean of Graduate Studies

## ABSTRACT

Developing and maintaining a “completion mindset” is a necessary mental condition for online educational doctorate (EdD) and educational specialist (EdS) students to obtain their advanced degrees. The purpose of this research study was to examine the effect of a neuroeducational intervention on a volunteer convenience sample of EdD and EdS students enrolled in online research and analysis courses at a private central Virginia university to determine if the intervention would have a positive effect on the level of perseverance through the stages of practical inquiry when compared to a control group. The independent variable was a web-based instructional method consisting of seven weekly multi-media modules, a creativity survey to enhance intrapersonal knowledge, and a weekly self-report instrument to foster relatedness and to protect for treatment fidelity. The four dependent variables were end-of-course grades, a self-determination survey, and two persistence instruments. An experimental posttest, control-group only research design was used to measure the magnitude of the effect for this intervention. The problem addressed by this study was the high attrition rate for online doctoral students, and the potential for using a neuroeducational intervention to positively affect perseverance. Due to the short-term nature of this intervention (seven weeks), perseverance was defined as completion of the practical inquiry cycle; therefore, additional research will be required to explore the longitudinal impact on perseverance related to attrition rates. The null hypotheses were not rejected; however, the means of the treatment group were higher than the control group for all measures except autonomy.

Descriptors: Adult learning; Brain efficiency; Cognitive Presence; Doctoral attrition; Emotional intelligence; Mental efficiency; Neuroeducation; Perseverance; Persistence; Practical inquiry; Self-determination; Spirituality; Volition.

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## TABLE OF CONTENTS

<b>ABSTRACT</b> .....	<b>iii</b>
<b>ACKNOWLEDGEMENTS</b> .....	<b>iv</b>
<b>TABLE OF CONTENTS</b> .....	<b>v</b>
<b>LIST OF TABLES</b> .....	<b>ix</b>
<b>LIST OF ABBREVIATIONS</b> .....	<b>xi</b>
<b>CHAPTER ONE: INTRODUCTION</b> .....	<b>1</b>
<b>Conceptual Framework</b> .....	<b>5</b>
<b>Adult Learning Theory (Andragogy)</b> .....	<b>7</b>
<b>Self-Determination Theory</b> .....	<b>11</b>
<b>Self-efficacy Theory</b> .....	<b>12</b>
<b>Social and Emotional Intelligence Theory</b> .....	<b>12</b>
<b>Neuroeducation</b> .....	<b>14</b>
<b>Problem Statement</b> .....	<b>15</b>
<b>Purpose Statement</b> .....	<b>17</b>
<b>Significance of the Study</b> .....	<b>18</b>
<b>Research Questions and Hypotheses</b> .....	<b>19</b>
<b>Research Question One and Hypotheses</b> .....	<b>20</b>
<b>Research Question Two and Hypotheses</b> .....	<b>20</b>
<b>Research Question Three and Hypotheses</b> .....	<b>21</b>
<b>Research Question Four and Hypotheses</b> .....	<b>25</b>
<b>Identification of Variables</b> .....	<b>25</b>
<b>Independent Variables (IV): The Treatment</b> .....	<b>25</b>
<b>Dependent Variables (DV)</b> .....	<b>26</b>
<b>Definitions</b> .....	<b>27</b>
<b>CHAPTER TWO: REVIEW OF THE LITERATURE</b> .....	<b>30</b>
<b>Sources of Data</b> .....	<b>30</b>
<b>Gap in the Literature</b> .....	<b>31</b>
<b>Neuroeducation</b> .....	<b>35</b>
<b>Construct of Perseverance</b> .....	<b>40</b>

Brain Optimization .....	40
Mindfulness .....	51
Emotional Intelligence (EI) .....	55
Self-Determination .....	59
Conclusion .....	63
<b>CHAPTER THREE: METHODOLOGY .....</b>	<b>66</b>
Research Design .....	66
Research Questions and Hypotheses .....	67
Research Question One and Hypotheses .....	67
Research Question Two and Hypotheses .....	68
Research Question Three and Hypotheses .....	69
Research Question Four and Hypotheses .....	72
Participants.....	73
Online Course: Advanced Educational Statistics (EDUC 712) .....	73
Online Course: Quantitative Methods of Research (EDUC 715) .....	74
Online Course: Advanced Research and Writing (EDUC 798).....	74
Online Course: Qualitative Methods of Research (EDUC 817) .....	74
Group Designation .....	74
Setting.....	76
Community of Inquiry for the Treatment Group.....	76
The Intervention Website.....	77
Instrumentation.....	79
End-Of-Course Grades.....	79
Self-Determination Survey .....	80
College Persistence Questionnaire.....	81
Chi-Square Distribution for Course Completion.....	82
Data Analysis.....	84
Research Question One .....	84
Research Question Two and Three .....	85
Research Question Four .....	88
Summary.....	89
<b>CHAPTER FOUR: RESULTS .....</b>	<b>90</b>
Descriptive Statistics.....	90

<b>Research Question One and Related Hypotheses .....</b>	<b>91</b>
<b>Descriptive Statistics.....</b>	<b>92</b>
<b>Assumption Testing for Research Question One .....</b>	<b>93</b>
<b>Results for Research Question Number One.....</b>	<b>96</b>
<b>Internal Reliability Test for the GCOS and CPQ.....</b>	<b>96</b>
<b>Research Question Two and Related Hypotheses.....</b>	<b>98</b>
<b>Descriptive Statistics for Research Question Two .....</b>	<b>100</b>
<b>Assumption Testing for Research Question Two.....</b>	<b>101</b>
<b>Results for Research Question Number Two .....</b>	<b>101</b>
<b>Research Question Three and Related Hypotheses .....</b>	<b>103</b>
<b>Descriptive Statistics .....</b>	<b>106</b>
<b>Assumption Testing for Research Question Three .....</b>	<b>107</b>
<b>Results of Inferential Statistics for Research Question Three.....</b>	<b>111</b>
<b>Research Question Four and Related Hypotheses .....</b>	<b>115</b>
<b>Descriptive Statistics for Research Question Four .....</b>	<b>115</b>
<b>Assumption Testing for Research Question Four .....</b>	<b>116</b>
<b>Results of Inferential Statistics for Research Question Four.....</b>	<b>116</b>
<b>Summary.....</b>	<b>117</b>
<b>CHAPTER FIVE: DISCUSSION.....</b>	<b>120</b>
<b>Problem Statement.....</b>	<b>121</b>
<b>Review of Methodology .....</b>	<b>122</b>
<b>Interpretation of Results .....</b>	<b>124</b>
<b>Quantitative Analysis.....</b>	<b>124</b>
<b>Qualitative Analysis .....</b>	<b>130</b>
<b>Theoretical Implications.....</b>	<b>132</b>
<b>Limitations.....</b>	<b>137</b>
<b>Implications for Practice .....</b>	<b>139</b>
<b>Implications for the Student .....</b>	<b>139</b>
<b>Implications for Higher Education.....</b>	<b>140</b>
<b>Recommendations .....</b>	<b>141</b>
<b>Summary.....</b>	<b>142</b>
<b>Implications for Future Research.....</b>	<b>142</b>
<b>Summary and Conclusions .....</b>	<b>144</b>
<b>REFERENCES.....</b>	<b>147</b>

<b>APPENDIX A: IRB Approval .....</b>	<b>176</b>
<b>APPENDIX B: AGE RANGES .....</b>	<b>177</b>
<b>APPENDIX C: COLLEGE PERSISTENCE QUESTIONNAIRE .....</b>	<b>178</b>
<b>APPENDIX D: GENERAL CAUSALITY ORIENTATIONS SCALE.....</b>	<b>187</b>
<b>APPENDIX E: INTERVENTION .....</b>	<b>197</b>
<b>APPENDIX F: SELF-REPORT EXAMPLE .....</b>	<b>208</b>



## LIST OF TABLES

	<u>Page</u>
Table 3.1: Neuroeducational Intervention	78
Table 3.2: Internal Consistency Estimates of Reliability for CPQ	82
Table 4.1: Descriptive Statistics for Independent-Samples <i>t</i> Test	92
Table 4.2: Internal Consistency Estimates of Reliability for CPQ and CPQ	98
Table 4.3: Descriptive Statistics for General Causality Orientations Scale	99
Table 4.4: Correlations for General Causality Orientations Scale	100
Table 4.5: Descriptive Statistics for College Persistence Questionnaire	107
Table 4.6: Test for Multivariate Normality	108
Table 4.7: Test for CPQ Subscales	111
Table 4.8: Chi-Square 2 x 2 Contingency Table	116
Table 4.9: Chi-Square Tests for Persistence	117
Table 5.1: Results for Research Question One	124
Table 5.2: Results for Research Question Two	126
Table 5.3: Results for Research Question Three	128
Table 5.4: Results for Research Question Four	130

## LIST OF FIGURES

	<b><u>Page</u></b>
Figure 4.1: Normality Distribution for the Treatment Group	94
Figure 4.2: Boxplot Indicating Extreme Outliers	95
Figure 4.3: Boxplots for Financial Strain	114

## LIST OF ABBREVIATIONS

- All-But-Dissertation – ABD
- Analysis of Variance – ANOVA
- College Persistence Questionnaire – CPQ
- Doctorate of Education – EdD
- Educational Specialist – EdS
- Electroencephalogram – EEG
- Emotional Intelligence – EI
- EI Self-Report Measure – EQ-I 2.0<sup>®</sup>
- Functional Magnetic Resonance Imaging – fMRI
- General Causality Orientations Scale – GCOS
- Internal Review Board – IRB
- Magnetoencephalogram – MEG
- Mayer-Salovey-Caruso Emotional Intelligence Test – MSCEIT
- Mind, Brain, and Education – MBE
- Multifactor Emotional Intelligence Scale – MEIS
- Multivariate Analysis of Variance – MANOVA
- Positron Emission Tomography – PET
- Post Hoc Power – PHP
- Self-Determination Theory – SDT
- Social and Emotional Learning – SEL
- Creative problem-solving survey – VIEW

## CHAPTER ONE: INTRODUCTION

The purpose of Chapter One is to establish a framework for this research study and to introduce the reader to the problem being addressed by the research, background on the subject matter, relevant theoretical frameworks, and the significance and purpose of the research to addressing a gap in the literature.

The six year growth for doctorates awarded through 2009 had increased by more than 7,000 to 49,562, a 17.7% growth rate (Fiegener, 2010); however, the attrition rates are significant, and with the growth in online learning, many practitioners are looking for interventions (CGS, 2010; Rockinson-Szapkiw & Spaulding, 2012; Rovai, 2007). For distance education doctoral programs, which include online and blended learning programs (Vaughan & Garrison, 2005), the attrition rate is 10% to 50% higher than the 50% attrition rate in traditional programs (Ivankova & Stick, 2007; Rockinson-Szapkiw, Dunn, & Holder, 2011; Rockinson-Szapkiw & Spaulding, 2012; Vaughan & Garrison, 2005). Student perseverance (persistence) through advanced degree attainment should be of extreme importance to institutions of higher education in light of the growing increase in distance learning programs; otherwise, attrition rates could be perceived by future students and the general public as the institution's inability to meet student needs (Pauley, Cunningham, & Toth, 1999; Rovai, 2003).

Researchers have related the reasons for the lack of perseverance and high online attrition to low levels of interaction with faculty and peers (connectedness), student self-regulation, student motivation, the online learning design, personal issues, learning styles, a reduced sense of community, social isolation, technology limitations, the lack of institutional resources, and the transition from a dependent-participant learner in the

coursework stage to a self-directed and isolated learner in the ABD stage (Beutel et al., 2010; CGS, 2010; Davidson, Beck, & Milligan, 2009; Glatthorn & Joyner, 2005; Ivankova & Stick, 2007; Lovitts, 2005; Pauley et al., 1999; Rockinson-Szapkiw, Dunn, & Holder, 2010; Rockinson-Szapkiw et al., 2011; Rovai, 2002; Rovai, 2003; Santo, 2006; van Gelderen, 2012; West, Gokalp, Pena, Fischer, & Gupton, 2011).

Rovai (2007) indicated that student motivation is the single most important predictor of student perseverance in distance education, and proposed five strategies for fostering improved online instruction to create motivation for students:

- a) Develop social presence in the virtual classroom.
- b) Avoid becoming the center of all discussions; emphasize student-to-student interactions.
- c) Attend to issues of social equity based on different cultural communication patterns.
- d) Attend to issues of social equity based on different gender-related communication patterns.
- e) Increase the status of low status students in order to promote equitable collaborations. (p. 79)

Student perseverance in the face of difficulty or change, such as moving to the dissertation development phase from coursework or to taking online courses, requires an enterprising behavior (motivation, resilience, and autonomy) to persist through degree completion (Glatthorn & Joyner, 2005; Rovai, 2007; Santo, 2006; van Gelderen, 2012). Faculty and administrators can influence student behavior by improving the design and facilitation of online instruction and by initiating early interventions (Bandura, 1977;

CGS, 2010; Diaz, 2002; Garrison & Cleveland-Innes, 2005; Rovai, 2007; van Merriënboer & Sweller, 2010). The community of inquiry, which includes social presence, teaching presence, and cognitive presence, should support deep learning, and the online course should have the structure and leadership to enable students to develop a sense of volitional involvement (Garrison & Cleveland-Innes, 2005; Deci, Vallerand, Pelletier, & Ryan, 1991). Garrison and Cleveland-Innes (2005) further noted that “empathy” is also a contextual factor required to facilitate deep learning.

Without perseverance, online students may withdraw or drop out of their advanced degree programs. Attrition rates at or above 50% could be perceived by future students and the general public as an inability of institutions of higher education to meet student needs (Pauley et al., 1999). Attrition creates unrecoverable costs in admissions, advising, planning, and the running of advanced degree programs, which could explain why student retention has become a big business for researchers, educators, and entrepreneurs (Smith, Maroney, Nelson, Abel, & Abel, 2006; Tinto, 2006).

The problem addressed by this study was the high attrition rate for online doctoral students, and the potential for using a neuroeducational intervention to positively affect perseverance. Due to the short-term nature of this intervention (seven weeks), perseverance was defined as completion of the practical inquiry cycle for online EdD and EdS students enrolled in research and analysis courses; therefore, additional research may be required to explore the longitudinal impact on perseverance related to attrition rates. The measurements were academic performance (end-of-course grades), self-determination (GCOS survey), and persistence levels (two instruments: CPQ survey and a chi-square 2 x 2 contingency distribution). The intervention designed for this study was

a seven-week asynchronous teaching strategy that provided instruction on brain optimization, mindfulness, emotional intelligence, and self-determination, which are factors related to perseverance and cognitive presence (Duckworth, Peterson, Matthews, & Kelly, 2007; Vaughan & Garrison, 2005). The participants were a randomized convenience sample of online EdD and EdS students enrolled in research and analysis courses at a private central Virginia university.

The effect of this intervention may provide empirical evidence for adding neuroeducation as a new form of teaching presence to enhance the community of inquiry for non-traditional students. Non-traditional students, those more than 24 years of age who have family and work responsibilities (Rovai, 2003), should be able to identify and receive the program support services needed to enable them to persevere in their advanced degree endeavors (CGS, 2010; Lovitts, 2005; Pauley et al., 1999; Rovai, 2002; West et al., 2011), and these program support services should be developed with awareness of theories and research on the community of inquiry, social forces, stages of human development, and learning styles (Garrison & Cleveland-Innes, 2005; Parkay, Anctil, & Hass, 2010; Rovai, 2003; Santo, 2006). The conceptual framework guiding this study is that perseverance is an outcome of the inter-relationships between brain optimization, mindfulness, emotional intelligence, and self-determination. This construct will be measured by four instruments: academic achievement (grades), a self-determination survey (GCOS), a college persistence questionnaire (CPQ), and a chi-square 2 x 2 contingency distribution.

## **Conceptual Framework**

The brain is widely known to be the central processor that interacts with present and past sensory data and experiences. As the learning center and storage facility, the brain processes both internal and external stimuli and releases directions through neurotransmitters to guide a person's response to the stimuli (Friston, 2010; Thayer & Brosschot, 2005). Theories do not capture the uniqueness of each person's brain or how it reacts to sensory data; however, theories do capture how a person may theoretically behave based on research interventions (Rabipour & Raz, 2012). The brain's neural pathways develop in response to context, genetics, experience, risk/reward, nurture, and education (Amen, 2005; Blomstrand, 2006; Friston, 2010; Friedlander et al., 2011; Garrison & Cleveland-Innes, 2005), and guide thinking processes (Akyol & Garrison, 2011; Deci et al., 1991; Rovai, 2003), which affect cognitive presence in the community of inquiry (Akyol & Garrison, 2011). The purpose of a community of inquiry is to "create and sustain" a high-level learning experience (Garrison & Cleveland-Innes, 2005; Vaughan & Garrison, 2005). Neuroeducation can provide a program of instruction that informs online EdS and EdD students about how the brain responds to stimuli, such as stressors, thereby offering a new perspective on cognitive and emotional processing along with direction on how to develop personal strategies to ensure cognitive presence within a community of inquiry (Akyol & Garrison, 2011; Rovai, 2003; Rovai, 2007). Early interventions that teach perseverance strategies, such as the one used in this research study, could foster a state of optimal brain functioning, and have a positive effect on academic achievement, self-determination, and persistence (Akyol & Garrison, 2011; Duckworth et al., 2007; Pauley et al., 1999; Rovai, 2003; van Gelderen, 2012). Caine and



Caine (1991) posited two general categories for achieving optimal brain functioning: a relaxed nervous system and intrinsic motivation. These two categories were inherent to the intervention utilized in this research study, and were operationalized through a course of instruction that used neuroeducation to foster self-determination and perseverance through the stages of practical inquiry for research and analysis courses.

The neuroeducational intervention used in this study presented instruction on key brain optimizing methods, such as mindfulness, emotional intelligence, creativity, visualization of performance, playfulness, completion mindsets, goal-setting, self-endorsement, self-monitoring, and self-rewarding activities, to establish a persevering attitude. The benefits of perceived efficacy, receiving encouragement from others, asking for and receiving frequent external feedback, initiating self-inquiry, performing weekly self-evaluations and self-reports, seeking testimonials from successful students, modeling efficacious behavior, using stress mitigation and relaxation strategies such as listening to music and meditation, and creating a personal learning contract have been researched and found to be successful heuristics (Bandura, 1977; Caine & Caine, 1991; Green & Bowden, 2012; Harmison, 2011; Knowles, 1977; Landers, Maxwell, Butler, & Fagen, 2001; Lane, Thelwell, Lowther, & Devonport, 2009; Rovai, 2007; Ryback, 2006). Cognitive presence, one of the factors in the model of a community of inquiry along with teaching presence and social presence, involves the neural processing components of analysis, construction, and confirmation of meaning operationalized through practical inquiry, “sustained” discourse, and reflection (Akyol & Garrison, 2011; Vaughan & Garrison, 2005). The sustained discourse and reflection are elements of deep learning.

Theories related to andragogy, self-determination, and social and emotional intelligence are presented below. Each of these theories seeks to explain a theoretical framework underscoring the behavior of individuals and groups of individuals in various ethological contexts.

### **Adult Learning Theory (Andragogy)**

College student ages vary from seventeen to more than sixty-five (CGS, 2009; Manheimer, 2005), with the median age for EdD graduates in 2007 reported at 42.3 years of age (CGS, 2009). Elementary through secondary education, which is referred to as pedagogy, recognizes the developmental stage changes of students, and tailors instruction to each stage (Miller, 2011); however, adults also have developmental stage changes, and Knowles (1977) identified five principles that specifically characterize the adult learner's differences from children: they are self-directed, have an extensive depth of experience, are ready to learn, intrinsically motivated, and task centered. Although the attributes of adult learners identified by Knowles (1977) offer an explanation for the learning differences between adults and children, the age variances in these adults and the differences in their learning needs and motives are typically ignored (Borges, Manuel, Elam, & Jones, 2010). Assuming these five principles are the inherent characteristics of adult learners, then online instruction and support services should be tailored to engage these adults with skill development and resources, which will serve to strengthen perseverance factors (Aarts & Dijksterhuis, 2000; Castro, Garcia, Cavazos, & Castro, 2011; CGS, 2010; Gliebe, 2012; Kennedy & Shapiro, 2009; Knowles, 1977; Rovai, 2007; Vaughan & Garrison, 2005).

Adults also have different levels of emotional intelligence and develop strategies for decision-making tasks based on cultural and social experience (Dundes & Marx,

2006, Immordino-Yang & Fischer, 2009; Knowles, 1977; Thornton, 2003; Worthy, Gorlick, Pacheco, Schnyer, & Maddox, 2011). A Thematic Apperception Test was used to examine age-related differences in medical students (Borges et al., 2010). The researchers found an age-related difference in the motives of Millennials ( $n = 197$ ) and Generation Xers ( $n = 229$ ) (see Appendix B for age ranges), where Millennial students were drawn more to affiliation and achievement, and Generation Xers were drawn to power, i.e., the motive to influence others and the desire to have an impact on others. Friedlander et al. (2011) also identified adult learning differences from their empirical research into the neurobiological bases of learning, and found that neuroeducation could improve the performance of medical students. Thornton (2003) used a life-span perspective to study adults, and determined that adult learning (andragogy) is a “multi-theoretical framework,” which includes environmental, social, and age-related changes over an adult’s lifespan. Social change relates to a sense of connectedness, which has been empirically noted to be relevant to perseverance in the online doctoral program (Clark et al., 2006; Harris, 2006; Rovai, 2002; Rockinson-Szapkiw & Spaulding, 2012). The literature on age-related changes in adults suggests that adult connectedness and self-efficacy can be negatively affected due to an age-related decline in information processing speed (Rogers, Kang, & Miller, 2007; Salthouse, Berish, & Siedlecki, 2004); however, neuroeducational strategies exist that can be implemented to mitigate this decline, such as instruction on how to enhance creative problem solving and decision making, emotional intelligence, and brain coherence (Feiyue, Qinqin, Liying, & Lifang, 2009; Griffiths, Ryan, & Foster, 2011; Jaeggi, Buschkuhl, Jonides, & Perrig, 2008). Research has also demonstrated that nutrition, the amount and frequency of exercise,

engagement in pro-social activities, and the level of self-determination have an important role in adult learning, memory, and decision-making (Ainslie et al., 2008; Colcombe et al., 2004; Deci et al., 1994; Erickson et al., 2011; Gagne, 2003; Igase, Mizoguchi, Ogushi, Miki, & Ueki, 2010; Smith et al., 2010; Tang & Posner, 2009; Tully & Bolshakov, 2010), which are also outcomes from practical inquiry.

Rovai (2007) noted that the first element in an online course design strategy would be to create motivation for students to engage in practical inquiry, which is how cognitive presence is operationalized, i.e., a triggering event, exploration, integration, and resolution (Vaughan & Garrison, 2005). Santo (2006) postulated that the learner's computer skills and motivation may be the most influential factor to learning in an online environment. Each of the components of the practical inquiry cycle requires neural processing, which operationalizes imagination, reflection, creativity, problem solving, intuition, and insight with experience (Garrison, Anderson, & Archer, 2001). Since cognitive presence focuses on higher-order thinking processes, the neuroeducational intervention designed for this study utilized the VIEW instrument as a tool to enhance student self-awareness of change orientation, manner of processing (internal or external), and task orientation to affect critical discourse and reflection (Garrison et al, 2001; Treffinger, Selby, & Isaksen, 2007). The design and teaching approach influence how students approach their study in an online environment (Garrison & Cleveland-Innes, 2005), and this study's intervention was designed to influence online EdD and EdS student perseverance.

Adult learning theory generalizes that adults are self-directed suggesting that the "choices" they make assist them to move in a predetermined direction; however, without

self-regulation strategies in place to deal with distracting extraneous factors, adults can make choices that negatively impact their self-determination resulting in a reduced persistence level and lower academic performance (Bandura, 1977; Garrison & Cleveland-Innes, 2005; Green & Bowden, 2012; Knowles, 1977; Rovai, 2002; Ryback, 2006; Tang & Posner, 2009; Wolff & Ratner, 1999).

Choice theory relates to four factors: a sense of belonging, the flexibility to use creativity and problem-solving skills, control or power to implement decisions, and a feeling that the situation or subject matter is interesting or fun (Glasser, 1996). These four factors are the foundation of student motivation, and if these motivational factors are not met, students will not perform at their best (Glasser, 1996). Hoogstad (2008) reported that although these four factors represent “internal” motivation, which is the essence of Choice Theory, the broader population believes that individuals are primarily externally motivated, and that this external motivation could lead to emotional dependency. Hechter and Kanazawa (1997) agreed suggesting that a criticism of rational choice is the lack of realism. In other words, the assumption that individuals calculate the expected consequences and make the best decision ignores research to the contrary where people often act impulsively, emotionally, or out of habit. This impersonal motivation puts emphasis on disconnecting habits that counter volitional processes (Deci et al., 1991).

Dependent individuals are associated with disconnecting habits, such as blaming, complaining, punishing, threatening, criticizing, and rewarding in an attempt to control others (Hoogstad, 2008; Vallerand, Pelletier, & Koestner, 2008). These habits are “learned” behaviors and are representative actions from the limbic system of the brain where the perception of reality is assimilated (Amen, 2005; Blair, 2006). Dependent

individuals lack self-efficacy and interdependence, and often have an impersonal motivational orientation (Deci & Ryan, 1985). Neuroeducation can inform individuals about how their brain processes emotions, and can provide the methods and strategies that lead to self-efficacy, brain optimization, resilience, and social and emotional intelligence (Amen, 2005; Beer & Bhanji, 2011; Caine & Caine, 1991; Clauss-Ehlers, 2008; Luthar, Cicchetti, & Becker, 2000a; Luthar, Cicchetti, & Becker, 2000b). Self-awareness, positive self-talk, self-monitoring, stress mitigation strategies, and the process of writing down goals have been empirically proven to be effective in changing the impact of faulty emotions on decision making, especially in social situations (Akyol & Garrison, 2011; Amen, 2005; Beer & Bhanji, 2011). Neuroeducational techniques like the ones mentioned above can be learned and applied to positively influence choices that lead to improved academic performance, self-determination, and persistence (Brockelman, 2009; Heatherton, 2011; Johnson, 2011; McLachlan, & Hagger, 2010), which was a goal of this study's neuroeducational intervention.

### **Self-Determination Theory**

Self-determination theory (SDT) presents an organismic metatheory that highlights tendencies to internalize the regulation of uninteresting though important activities in two qualitatively different methods—introjection and integration—depending on the social context (Deci et al., 1994). Introjection is a form of forced self-regulation where coping skills may be required to achieve the value of an activity. Integration—a central component of intrinsic motivation—is when the process of pursuing an activity or goal is assimilated with a person's core sense of self. Humans operate on a continuum beginning at amotivation (lacking the intention to act) to extrinsically motivated to intrinsically motivated or self-determination (Deci & Ryan,

1985; Ryan & Deci, 2000). Deci et al. (1994) confirmed these orientations in an experiment with introductory psychology students ( $n = 192$ ), and also found that the social context, which is also an element of the community of inquiry, is important for integration. Self-determination can be enhanced by autonomy (self-regulation), and this autonomy can enable a person to cope with distracting extraneous factors while at the same time fostering self-efficacy (Bandura, 1977; Deci et al., 1991).

### **Self-efficacy Theory**

Introjection may require coping skills, and Bandura (1977) hypothesized that personal efficacy determines if coping behavior will be successful in the face of obstacles and adversity. He further noted that a person's willingness to persist is based on cognitive processes that code and retain experiences in memory, i.e., a neural pathway. These experiences establish standards by which a person pursues goals and measures self-regulation. If goal attainment is related to unaided effort, then self-determination, rather than ability, will enable individuals to internalize this achievement as personal competence. Goal-setting, positive self-talk, self-monitoring, and self-regulation are effective methods of becoming efficacious; however, self-efficacy can only be achieved through accomplishment of objectives that authenticate personal mastery over events, thereby strengthening neural pathways and emotional resilience (Bandura, 1977; Beer & Bhanji, 2011; Deci et al., 1991; Goleman, 2006; Hoogstad, 2008).

### **Social and Emotional Intelligence Theory**

Social and emotional processing is different from cognitive processing, as they are supported by separate neural structures in the limbic system of the brain (Bar-on, Tranel, Denburg, & Bechara, 2003; Wolff & Ratner, 1999). Social neuroscience is

broadening the understanding of how individuals interact with reality, and is helping disciplines—psychology, philosophy, sociology, linguistics, law, biology, and political science—explore complex concepts such as memory, empathy, attitudes, and choice (Johnson, 2011).

Recent research has demonstrated that emotive attitudes and internal evaluations can be impacted by time suggesting that higher-order decision making (emotional intelligence) takes place in a reflective state (Caine & Caine, 1991; Packer, Kesek, & Cunningham, 2011). Emotional intelligence (EI), formerly referred to as intra/interpersonal intelligence (Gardner, 2006), relates to cognitive competencies and skills that enable individuals to cope and be more effective in their personal lives by evaluating and potentially overriding initial emotional responses (Bar-on et al., 2003; Gardner, 2006; Goleman, 2006; Mayer, Caruso, & Salovey, 2000; Sternberg, 2003). Coping skills enable a person to resolve the emotional state of disequilibrium by recognizing and acquiring the resilient types of sensory inputs and environments that restore a sense of control and coherence (Thayer & Brosschot, 2005; Luthar et al., 2000a; Wolff & Ratner, 1999). EI abilities have been expanded into five different domains: self-awareness, emotional management, self-motivation, affective awareness, and social competence (Bar-on et al., 2003; Lane et al., 2009). Neuroeducation can teach strategies to influence emotional intelligence and well-being (Heatherston, 2011; Packer et al., 2011). EI abilities can enable people to develop habits that monitor and adjust their behavior, which may require them to delay gratification and stifle impulsivity (Aarts & Dijksterhuis, 2000; Bar-on et al., 2003; Packer et al., 2011).



## **Neuroeducation**

The theories espoused above are each dependent on the brain's proper functioning, which can be influenced by neuroeducation (Amen, 2005; Friedlander et al., 2011; Posner, 2010). Neuroeducation, also referred to as brain-based training, the neurobiology of learning, and MBE (mind, brain, and education) is a program of study which recognizes that decision making, behavioral responses, physiological functioning, learning, and memory all originate in the brain (Caine & Caine, 1991; Friedlander et al., 2011; Hardiman, 2010; Immordino-Yang & Fischer, 2009; Rabipour & Raz, 2012). Neuroeducation specifically refers to a program or activity that seeks to enhance a cognitive skill or ability through a course of instruction over a designated timeframe (Rabipour & Raz, 2012). Five core concepts comprise the field of neuroeducation: human development is shaped by a synergy of biology and experience; emotion is fundamental to learning; there are developmental sensitivities for certain aspects of language learning; the literate brain can be created through multiple developmental pathways; and mathematics is created in the brain with biology and instruction (Hinton, Miyamoto, & Della-Chiesa, 2008). Rockinson-Szapkiw and Spaulding (2012) added that personal attributes, which are manifested in the brain, mattered for doctoral persistence, and similarly Laskey and Hetzel (2011) found that a person's personality factors influence retention and college GPA.

To persevere toward a goal (volitional process) is a principle of human nature, and perseverance requires mindfulness, resilience, autonomy, and a "completion mindset" (Deci et al., 1991; Deci et al., 1994; Garrison, 2003; Green & Bowdin, 2012; Luthar et al., 2000a; Vallerand, 2000; van Gelderen, 2012). This mindset is necessary for

academic resilience, a factor of perseverance defined as the ability to persist in an educational program despite exposure to risk factors (Castro et al., 2011), and this resiliency may be impaired without brain optimization, mindfulness (metacognitive awareness), emotional intelligence (adaptive and coping skills), and self-determination (Garrison, 2003; Thayer & Brosschot, 2005; Luthar et al., 2000b; Vallerand, 2000). To develop skills that strengthen these resiliency factors related to perseverance, online EdD and EdS students may benefit from a neuroeducational intervention (Banks & Zionts, 2010; Castro et al., 2011; Deci et al., 1991; Green & Bowdin, 2012; Hardy, Drescher, & Sarkar, 2011; Hillman, Erickson, & Kramer, 2008; Pauley et al., 1999; Pool & Qualter, 2012; Ryan & Niemiec, 2009; Travis et al., 2008; West et al., 2011). Each of these skills depends on salutogenesis or a strong sense of coherence, i.e., brain efficiency (Castro et al., 2011; Luthar et al., 2000b; Vallerand, 2000).

The neuroeducational intervention constructed for this research study was a strategy designed to provide information about how brain optimization, mindfulness, emotional intelligence, and self-determination influence perseverance and academic resilience.

### **Problem Statement**

Pauley et al. (1999) noted that high attrition rates at an institution of higher education could be perceived by future students and the general public as an inability to meet student needs. These authors further reported that doctoral program attrition creates unrecoverable costs in admissions, advising, planning, and running of the program. These costs could explain why student retention has become a big business for researchers, educators, and entrepreneurs (Tinto, 2006).

Glatthorn and Joyner (2005) highlighted that finishing the dissertation is a time when many graduate students have trouble; however, research and analysis courses are also a time when students have trouble (Field, 2009). Perseverance toward an advanced degree requires enhanced brain functioning (optimization), mindfulness (intrapersonal intelligence), emotional intelligence, and self-determination to internalize a completion mindset (volition), and to avoid choices that lead to dropping out or postponing the process (Deci et al., 1991; Green & Bowdin, 2012; Rovai, 2003). Completing the EdD or EdS degree is a choice, working to master statistical designs and analysis is a choice, and anytime students are faced with distractions or adversity, the manner in which they respond is a choice that expresses their resilient behavior (Duckworth et al., 2007; Gu & Day, 2007; Martin, 2011; Rovai, 2003; van Gelderen, 2012). Choice can be positively influenced by brain optimization, self-efficacy, self-regulation, emotional resilience, and mindfulness, which are relevant skills needed for perseverance (Deci, Eghrari, Patrick, & Leone, 1994; Goleman, 2006; Green & Bowden, 2012; Thayer & Brosschot, 2005).

Student choice to stay in an online EdD or EdS degree program could be negatively influenced by deficits in brain functioning, unrealistic expectations, unrealistic timeframes, or an unwillingness to work with online technologies, which may require multiple sign-ons, lack storage capability, provide inadequate structure between modules, and that offer difficulty accessing real-time support (Rovai, 2002; Rovai, 2003; Rovai, 2007; Thayer & Brosschot, 2005). Support services that mitigate student risk within the online EdD and EdS programs should be continuously evaluated for improvement opportunities, or stated differently, all students should be considered “at risk” (Hermanowicz, 2006). West et al. (2011) found in their study ( $n = 103$ ) that support

practices are significant toward retention of EdD students, as did Rockinson-Szapkiw and Spaulding (2012) in their research.

The problem addressed by this study was the high attrition rate for online doctoral students, and the potential for using a neuroeducational intervention to positively affect perseverance. Due to the short-term nature of this intervention (seven weeks), perseverance was defined as completion of the practical inquiry cycle for online EdD and EdS students enrolled in research and analysis courses; therefore, additional research may be required to explore the longitudinal impact on perseverance related to attrition rates. The neuroeducational intervention was a seven-week asynchronous teaching strategy that provided instruction on brain optimization, mindfulness, emotional intelligence, and self-determination, which are factors related to perseverance and human conduct. The participants were a randomized convenience sample of online EdD and EdS students enrolled in research and analysis courses. The effect of the intervention was measured by end-of-course grades, a self-determination assessment, and two persistence assessments. This intervention, which integrated neuroeducation with learning theories, may have the further potential for reducing online EdD and EdS attrition rates, and the creation of new and effective early interventions (Bandura, 1977; Banks & Zions, 2010; CGS, 2010; Harmison, 2011; Pauley et. al., 1999; Rockinson-Szapkiw & Spaulding, 2012; Rovai, 2002; Tinto, 2006; West et al., 2011). In Chapter Two of this manuscript, the conceptual framework presented will be that perseverance is influenced by brain optimization, mindfulness, emotional intelligence, and self-determination.

### **Purpose Statement**

The purpose of this research study was to examine the effect of a neuroeducational intervention, which provided instruction on brain optimization,

mindfulness, emotional intelligence, and self-determination on a volunteer convenience sample of EdD and EdS students enrolled in online research and analysis courses at a private central Virginia university to determine if the intervention would have a positive effect on the level of perseverance through the stages of practical inquiry when compared to a control group. The independent variable was an instructional method consisting of seven weekly multi-media modules with instruction on mindfulness (intrapersonal intelligence), brain functionality, emotional intelligence, and self-determination. Included in the intervention were relaxation activities, words of encouragement, a creativity survey to enhance self-knowledge and self-awareness, and a weekly online self-report instrument. The instructional method consisted of two groups (treatment and control), where the control group received no instruction. The dependent variables in this study were end-of-course grades, a self-determination survey, and two persistence assessments.

### **Significance of the Study**

The significance of this research study is that an early neuroeducational intervention, which provides instruction on brain optimization, mindfulness, emotional intelligence, and self-determination, may increase the level of perseverance for online EdD and EdS students. This increased level of perseverance could lower the higher attrition rates for online students thereby benefitting both higher educational institutions and advanced degree students. Higher education should strive to equip all students with the best-practice support services needed for them to be successful in their advanced degree endeavors (CGS, 2010; Gliebe, 2012; Green & Bowden, 2012; Hermanowicz, 2006; Ivankova & Stick, 2007; Laskey & Hetzel, 2011; Pauley et al., 1999; Rockinson-Szapkiw & Spaulding, 2012; Tinto, 2006; West et al., 2011).

This study should add to the empirical knowledge base and potentially influence professors to use neuroeducation as a cross-domain strategy in their teaching and student support methodology. Further, online EdD and EdS students may enjoy a transforming experience that adds to their self-knowledge, perceived self-efficacy, emotional resilience, and sense of well-being (Bandura, 1977; Knowles, 1977; Rovai, 2002; Pauley et al., 1999; West et. al., 2011), which could enhance emotional intelligence, foster cognitive presence, and enhance academic achievement, self-determination, and persistence thereby enabling them to complete their EdD or EdS degree programs. Knowledge of how the brain processes cognition, social engagement, and emotions may enable online EdD and EdS students to control how they respond to course stressors and to develop personal competence, thereby enhancing resilience (Bandura, 1977; Caine & Caine, 1991; Clauss-Ehlers, 2008; Wolff & Ratner, 1999). This type of mindfulness is related to intrapersonal and social intelligence, and neuroeducation is a strategy to integrate brain research with inner awareness (Green & Bowden, 2012; Ryback, 2006). Using knowledge about brain optimization, mindfulness, emotions, and self-determination to control human conduct may enable online EdD and EdS students to work on internal weaknesses that may negatively impact a completion mindset (Green & Bowden, 2012; Hoffman, 2012).

### **Research Questions and Hypotheses**

The following are the research questions with their null research hypotheses and their alternative hypotheses:

## **Research Question One and Hypotheses**

Does the online neuroeducational intervention have a significant effect on online EdD and EdS students' research and analysis end-of-course grades?

**H<sub>01</sub>:** There will be no effect on end-of-course instructor-provided grades for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A1</sub>:** There will be a significant effect on end-of-course instructor-provided grades for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

## **Research Question Two and Hypotheses**

Will the online neuroeducational intervention have a significant effect on online EdD and EdS students' self-determination scores?

**H<sub>02.1</sub>:** There will be no effect on composite self-determination scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A2.1</sub>:** There will be a significant effect on composite self-determination scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>02.2</sub>:** There will be no effect on impersonal orientation for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A2.2</sub>:** There will be a significant effect on impersonal orientation for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>02.3</sub>:** There will be no effect on controlled orientation for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A2.3</sub>:** There will be a significant effect on controlled orientation for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>02.4</sub>:** There will be no effect on autonomy orientation for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A2.4</sub>:** There will be a significant effect on autonomy orientation for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

### **Research Question Three and Hypotheses**

Will the online neuroeducational intervention have a significant effect on online EdD and EdS students' college persistence questionnaire scores?

**H<sub>03.1</sub>:** There will be no effect on composite persistence scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.



**H<sub>A3.1</sub>:** There will be a significant effect on composite persistence scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>03.2</sub>:** There will be no effect on institutional commitment scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A3.2</sub>:** There will be a significant effect on institutional commitment scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>03.3</sub>:** There will be no effect on degree commitment scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A3.3</sub>:** There will be a significant effect on degree commitment scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>03.4</sub>:** There will be no effect on academic integration scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A3.4</sub>:** There will be a significant effect on academic integration scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>03.5</sub>:** There will be no effect on social integration scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A3.5</sub>:** There will be a significant effect on social integration scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>03.6</sub>:** There will be no effect on advising effectiveness scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A3.6</sub>:** There will be a significant effect on advising effectiveness scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>03.7</sub>:** There will be no effect on collegiate stress scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A3.7</sub>:** There will be a significant effect on collegiate stress scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>03.8</sub>:** There will be no effect on financial strain scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A3.8</sub>:** There will be a significant effect on financial strain scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>03.9</sub>:** There will be no effect on scholastic conscientiousness scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A3.9</sub>:** There will be a significant effect on scholastic conscientiousness scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>03.10</sub>:** There will be no effect on academic efficacy scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A3.10</sub>:** There will be a significant effect on academic efficacy scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>03.11</sub>:** There will be no effect on academic motivation scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional when compared to a control group.

**H<sub>A3.11</sub>:** There will be a significant effect on academic motivation scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

## **Research Question Four and Hypotheses**

Will the online neuroeducational intervention have a significant effect on online EdD and EdS students' persistence in their research and analysis course?

**H<sub>04</sub>**: There will be no significant difference between the EdD and EdS students participating in the treatment group, who persist in their research and analysis course, when compared to a control group.

**H<sub>A4</sub>**: There will be a significant difference between the EdD and EdS students participating in the treatment group, who persist in their research and analysis course, when compared to a control group.

### **Identification of Variables**

#### **Independent Variables (IV): The Treatment**

The independent variable used in this study was a neuroeducational intervention with two levels (a treatment group and a control group). This intervention was an online instructional method in the form of a 25 page website constructed for this purpose and consisting of the instructional elements: (a) seven weekly multi-media modules about self-determination, brain efficiency, and emotional intelligence; (b) a creativity survey to be given as a method for increasing student self-knowledge about their unique problem-solving styles; and (c) web-links to humor, inspiration, selected spiritual encouragement from the Bible, and a weekly blog post for encouragement. The control group received no instruction but received end-of-course links to the GCOS and CPQ survey questions. The treatment group in this study was directed to access the website each week during the statistics course, to complete selected weekly activities to include submitting a self-report form, and to submit two end-of-course surveys (GCOS and CPQ) in week seven or eight

of their coursework. The estimated time to complete each weekly lesson was designed to be no more than 30 minutes.

### **Dependent Variables (DV)**

The dependent variables were research and analysis grades taken from the instructor's grade book, a self-determination survey (GCOS), and two persistence assessments (a college persistence questionnaire (CPQ) and a chi-square analysis). The CPQ and GCOS were administered as a posttest during the last two weeks of the eight-week semester.

**Research and analysis grades.** These grades were taken from each instructor's grade book at the end of the course. The grade scale is interval, and the following information was taken from the course syllabus: A = 960–1010; A- = 940–959; B+ = 920–939; B = 890–919; B- = 870–889; C+ = 850–869; C = 820–849; C- = 800–819; D+ = 780–799; D = 750–779; D- = 730–749; and F = 729 and below. Akyol and Garrison (2011) performed a study of adult students enrolled in an online Master of Education program, and used grades to measure actual learning outcomes.

**Self-determination survey.** Self-determination was measured using the General Causality Orientations Scale (GCOS). The GCOS utilized for this measurement was a 36-item instrument that assessed three dimensions: autonomy orientation ( $\alpha = 0.744$ ), controlled orientation ( $\alpha = 0.694$ ), and impersonal orientation ( $\alpha = 0.741$ ). The instrument was developed and used in a study conducted by Deci and Ryan (1985) and found to have construct validity for measuring the three dimensions mentioned above. See Appendix D for further information about the General Causality Orientations Scale. Permission to use the GCOS in this study was arranged through website permissions associated with

downloading the instrument. The neuroeducational intervention was designed to enhance autonomous behavior by educating students on the different types of locus of causality orientations.

**College persistence questionnaire.** The college persistence questionnaire (CPQ) is a 69-item self-report survey that measures: academic integration ( $a = 0.81$ ), social integration ( $a = 0.82$ ), support services satisfaction ( $a = 0.74$ ), degree commitment ( $a = 0.70$ ), institutional commitment ( $a = 0.78$ ), and academic conscientiousness ( $a = .063$ ) (Davidson et al., 2009). See Appendix C to view the authorization to use the form in this research study, and to view the questionnaire. As indicated earlier, each of these subscales represents a reason for attrition, and higher scores for the treatment group could indicate that the neuroeducational intervention was successful.

**Chi-Square persistence distribution.** A chi-square test is a non-parametric test that can be used to analyze the differences between two independent proportions (Howell, 2011). The test was used to determine if the proportion of EdD and EdS students in the treatment group, who drop out of one of the research and analysis courses, was proportionate to the control group. There are two primary assumptions for chi-square analyses: independence of observations, and expected frequencies larger than five responses (Field, 2009).

### **Definitions**

- Blended Learning: a program that integrates the best of face-to-face and online learning while significantly reducing traditional class contact hours (Vaughan & Garrison, 2005).

- Cognitive Presence: the analysis, construction, and confirmation of meaning and understanding within a community of learners through sustained discourse and reflection (Vaughan & Garrison, 2005).
- Community of Inquiry: the integration of cognitive, social, and teaching presence (Garrison & Cleveland-Innes, 2005) to achieve meaningful learning and achievement of cognitive outcomes (Vaughan & Garrison, 2005).
- Hemisphericity: left and right brain preferences and interactivity during information processing (Taggart, & Torrance, 1984).
- MBE (mind, brain, and education): education relating to the brain's "propensities for seeking, processing, and organizing information in order to maximize learning" (Immordino-Yang & Fischer, 2009; Rabipour & Raz, 2012; Tompkins, 2007).
- Neurobiology of learning: processes at the molecular, cellular, and systems levels that occur during learning, and the formation, storage, and recall of memories (Friedlander et al., 2011).
- Neuroeducation: also referred to as neuroscience and education, educational neuroscience, the neurobiology of learning, and MBE refers to a program or activity that seeks to enhance a cognitive skill or ability through a course of instruction over a designated timeframe, and is the integration of educational principles, psychology, biology, and cognitive science (Beauchamp & Beauchamp, 2012; Beer & Bhanji, 2011; Carew & Magsamen, 2010; Friedlander et al., 2011; Rabipour & Raz, 2012; Sousa, 2010).

- Neuroscience: a natural science that investigates the inner-workings of the brain, the functional architecture of the mind, and how the brain and mind map together (Devonshire & Dommett, 2010).
- Perseverance: voluntary continuation of action or behavior that is goal directed and typically in the face of difficulty or obstacles (Martin, 2011).
- Persistence: (used interchangeably with perseverance and self-regulation) to hold firmly and steadfastly to a purpose, state, or undertaking, despite obstacles, warning, or setbacks (American Heritage Dictionary, 1985; Martin, 2011; Rovai, 2003); sustained effort (Rovai, 2003).
- Practical Inquiry: the four stages of deep learning, which include a triggering event, exploration, integration, and resolution (Garrison, 2003).
- Resilience: the capacity to “bounce back”, to recover strengths or spirit quickly and efficiently in the face of adversity (Gu & Day, 2007); coping (Clauss-Ehlers, 2008); a dynamic process encompassing positive adaptation with the context of significant adversity (Luthar et al., 2000a); wellness (Luthar et al., 2000b).
- Volition: a psychological state that represents the mediating force between intentions to learn and behaviors to learn (Rovai, 2003); an act of willing, choosing or deciding (American Heritage Dictionary, 1985).



## **CHAPTER TWO: REVIEW OF THE LITERATURE**

### **Sources of Data**

The literature review is considered the foundation of the research project, and should accomplish several important objectives: setting the context, establishing the scope of the research, and examining the claims in existing literature to include the research methods utilized (Boote & Beile, 2005).

The purpose of this research study was to examine the effect of a neuroeducational intervention, which provided instruction on brain optimization, mindfulness, emotional intelligence, and self-determination on a volunteer convenience sample of EdD and EdS students enrolled in online research and analysis courses at a private central Virginia university to determine if the intervention would have a positive effect on the level of perseverance through the stages of practical inquiry when compared to a control group.

For this literature review, primary and secondary sources were examined and synthesized. These sources included scholarly journal articles located through search terms, doctoral dissertations, books, and Internet websites. In reviewing these sources, the reference lists associated with them were also examined. The majority of the scholarly articles were retrieved using on-line library access to educational databases provided by a private central Virginia university. Additional searches were conducted using EBSCO EJS and Google Scholar. Keyword searches on adult learning, brain efficiency, doctoral attrition, coherence, emotional intelligence, mental efficiency, mindfulness, neuroeducation, persistence, and self-determination were conducted. Material selected for

inclusion provided pertinent information to the understanding of the phenomenon of adult brain optimization and brain efficiency related to adult perseverance in higher education.

The review of the literature is presented in six sections—gap in the literature, neuroeducation, brain optimization, mindfulness, emotional intelligence, and self-determination—followed by a discussion that synthesizes the information. As presented in chapter one, andragogy, self-determination theory, self-efficacy theory, and social and emotional intelligence theory are inter-related with the brain’s neural functioning, which is fundamental to neuroeducation (Anderson, 2010; Caine & Caine, 1991; Friston, 2010; Thayer & Brosschot, 2005).

### **Gap in the Literature**

Perseverance, referred to as a volitional process (Deci et al., 1991; van Gelderen, 2012), is a complex principle of human nature that this research study examined. Volition is defined as a “psychological” state characterized by cognition about actions toward a goal, and operationalized by self-regulation (autonomous orientation) strategies in the contextual framework of persistence (Deci et al., 1991; Rovai, 2003; van Gelderen, 2012). Researchers suggest that there is a gap between research and practice, which has led to a “heightened” focus on finding successful intervention strategies to improve doctoral student persistence (Friedlander et al., 2011; MacCann, Fogarty, Zeidner, & Roberts, 2010; Rovai, 2003; Tinto, 2006; West et al., 2011). Davidson et al. (2009) reported that a “burgeoning” literature has developed to explore and understand the reasons behind the lack of student perseverance; however, Ryan and Niemiec (2009) reported that many graduate schools of education have a resistance to formal theories that

are based on quantitative empirical methods. The authors suggested that there are principles about human nature that can be empirically studied and reliably observed.

Rockinson-Szapkiw (2011) stated that due to a lack of study on interventions, a need exists to “identify” interventions that elevate “feelings” of connectedness and levels of satisfaction. Terrell, Snyder, and Dringus (2009) found that connectedness was lacking between distance learning students and faculty, and also reported a need for interventions to improve feelings of connectedness. The authors designed a Doctoral Student Connectedness Scale to identify students “at risk” for attrition. Garrison and Cleveland-Innes (2005) further suggested that additional studies should be conducted to understand the nature of online interaction that will support “high levels” of learning. Smith et al. (2006) proposed the need for stress management interventions to increase graduate student success rates and to reduce attrition rates of doctoral students. Vaughn and Garrison (2005) indicated that a “worthy” topic for further research would be interventions that focus on high-level learning processes and outcomes using blended learning designs. Igase et al. (2010) noted a desire for people to gain a better understanding of the importance of glucose metabolism, fat metabolism, and ketone synthesis with the brain. As online EdD and EdS programs grow, “effective and innovative” practices will need to increase to support the successful transition from structured coursework to unstructured dissertation writing (Lovitts, 2005; West et al., 2011).

Early interventions, i.e., orientation programs, should be developed to advise post-graduate students on the importance of “motivation” factors (Bandura, 1977; Pauley et al., 1999). Hermanowicz (2006) advised planners for future doctoral support services

to consider all students “at risk” when designing interventions to lower attrition. This author’s study found student selectivity for support services may ensure persistence, but it does not ensure retention. Ivankova and Stick (2007) stated that future research was needed to perform an “in-depth” exploration of distance education students’ persistence to understand and mitigate stressors. Rovai (2003) and Clauss-Ehlers (2008) highlighted the need for the development of “coping” skills, and van Gelderen (2012) and Vallerand (2000) added that the ability to know when to disengage or to know when to change the approach was important to perseverance and resilience. Rovai (2007) suggested that the effective construction of knowledge in an online environment required motivation and the establishment of social equity. Martin (2011) presented a gap in the literature relating the role of emotion to academic processes and outcomes. Garrison (2003) highlighted the importance of reflective inquiry, self-direction, and metacognition to higher-order learning, and suggested that educators have the responsibility to understand how to facilitate such learning.

The construct of the online community of inquiry where learners reflect and engage in meaningful discourse with “metacognitive” awareness and take responsibility to manage and monitor their learning progress needs to be empirically determined (Garrison, 2003). There is a gap between research and practice relating to interventions associated with online student perseverance in doctoral programs (Rockinson-Szapkiw, 2011). With the high rate of attrition in online EdS and EdD programs and the costly nature of this attrition to students and institutions, a successful neuroeducational intervention that enhances perseverance within the community of inquiry could be a significant addition to empirical research. The factors inherent to sustained motivation,

commitment, and effectiveness in professional endeavors should be explored (Gu & Day, 2007).

Interventions for university students have been shown to improve brain optimization, mindfulness, emotional intelligence, self-determination, and learning outcomes (Bandura, 1977; Brockelman, 2009; Friedlander et al., 2011; Garrison & Cleveland-Innes, 2005; McLachlan & Hagger, 2010; Pool & Qualter, 2012; Spence et al., 2004), which are predictors of academic performance (MacCann et al., 2010; Parker, Summerfeldt, Hogan, & Majeski, 2004), self-determination (Green & Bowden, 2012; Ryan & Deci, 2006), and persistence (Andrade, 2006; Clark et. al., 2006; Green & Bowden, 2012; Ivankova & Stick, 2007; Pauley et al., 1999; Rockinson-Szapkiw, 2011). Brain training alongside mainstream courses may be the beneficial strategy (Rabipour & Raz, 2012), and several studies support this type of brain-training intervention. Hardy et al. (2011) conducted a study using a web-based application developed by Lumos Labs ( $n = 23$ ;  $M age = 54$ ), and reported improved cognitive abilities for working memory and visual attention. Pool and Qualter (2012) successfully used a teaching intervention with university students ( $n = 134$ ;  $M age = 23$ ) to improve emotional intelligence and emotional self-efficacy. Brockelman (2009) conducted an online study ( $n = 375$ ) of college students, and found that a student's level of self-determination influenced academic performance (GPA). Vaughan and Garrison (2005) found in their study of college faculty that an increased emphasis on teaching presence could ensure perseverance through the resolution phases of the practical inquiry cycle.

As is obviated by the above researchers, the need for new and effective interventions that bridge research and practice in relation to improved learning outcomes

is not only necessary for enhancing perseverance through the stages of practical inquiry but also necessary to lower attrition rates.

### **Neuroeducation**

Neuroeducation is a relatively new discipline that seeks to blend neuroscience, psychology, cognitive development science, and education together to create a better understanding of how learning takes place, and how this information can be utilized to develop more effective teaching methods, curricula, and educational policy (Beauchamp & Beauchamp, 2012; Beer & Bhanji, 2011; Carew & Magsamen, 2010; Coch & Ansari, 2012; Friedlander et al., 2011; Hardiman, 2010; Immordino-Yang & Fischer, 2009; Rabipour & Raz, 2012; Sousa, 2010). Practitioners in the field of neuroeducation are not aligned in a common purpose (Purdy & Morrison, 2009; Schrag, 2011), and there are a number of neuromyths that impair alignment (Goswami, 2004; Goswami, 2006; Willingham, 2009). Some researchers in neuroscience seek to study how neuroimaging, drugs, and brain-based learning packages can impact learning problems (Devonshire & Dommett, 2010; Purdy & Morrison, 2009), while others question the deontology of neuroimaging (Dean, 2010) and the goal-centric nature of education, which is more qualitative in nature (Devonshire & Dommett, 2010; Willingham, 2009). There is a significant divide between neuroscientists and educators (Goswami, 2006), and this is most likely due to the inability to generalize brain mechanisms for learning and memory, which are subject to the effects of age, genetics, ecology, emotion, and motivation, to a one-size-fits-all teaching strategy (Blakemore & Bunge, 2012; Devonshire & Dommett, 2010).

Neuroscience, as a natural science, could inform educators about empirical research on how humans learn, attend, grow fatigued, resolve working memory demands, become motivated, work in social situations, and respond to authority (Goswami, 2006; Willingham, 2009). Immordino-Yang and Fischer (2009) discussed the interrelationship between brain functionality and learning, and explained that neural networks record the memories and processes involved in learning, and there is no one domain that houses specific memories. Hardiman (2010) presented a “best practices” brain-centric teaching model (neuroeducation) at the 27<sup>th</sup> Learning & the Brain Conference, which espoused the importance of brain functioning to learning. This type of teaching has been demonstrated through research to be effective in improving academic achievement and attitudes (Goswami, 2006; Lee & Hung, 2009; Uyangor, 2012).

Some neuroscience researchers are using neuroimaging (EEG, fMRI, lesion studies, MEG, MRI, and PET) to explore and understand how the human brain processes cognition, emotion, social, and personality-related stimuli in an effort to devise improved educational strategies (Jenkins & Mitchell, 2011). Neuroimaging research studies are conducted under the assumption that any change in mental state will make specific demands on the brain resulting in changes in neural activity (Goswami, 2004). The brain’s operations in response to arithmetic calculations, autobiographical memory, faces, music, object perception, reading and listening, risk and reward, self-reference, spatial navigation, and working memory loading are some of the processes empirically researched using neuroimaging (Posner, 2010). Other studies using neuroimaging have discovered that success in math, music, and processing geometric word/shape combinations are associated with hemisphericity and brain synchronicity (Bennet &

Bennet, 2008; Gier, Kreiner, Solso, & Cox, 2010; Szirony, Burgin, & Pearson, 2008), suggesting that the ability to think flexibly across hemispheres of the brain may impact the success of learners in different educational milieus (Deci et al., 1991; Garrison, 2003).

Neuroeducation, as presented in this research study, can alert individuals to the way they prefer to process novelty, solve problems, and approach difficult tasks thereby enabling brain optimization. Brain optimization is necessary for fluid intelligence, meta-cognition, creativity, and problem solving (Bennet & Bennet, 2008; Deary, Penke, & Johnson, 2010; Friedlander et al., 2011; Immordino-Yang & Fisher, 2009; Neubauer & Fink, 2009; Stankov et al., 2006; Treffinger et al., 2007); and is also important for cognitive presence (Vaughan & Garrison, 2005).

Teacher training programs are now incorporating theories and research about MBE, and major universities are beginning to add MBE to graduate programs (Immordino-Yang & Fischer, 2009); however, there remains a gap in the literature when it comes to using neuroeducational research to develop higher-education program support strategies that influence perseverance through the stages of practical inquiry and that reduce attrition (Friedlander et al., 2011; McLachlan & Hagger, 2010; West et al. 2011). Immordino-Yang and Fischer (2009) suggested that this could be due to the time period between conducting empirical research and finding practical applications. The authors postulated that people in education still do not recognize that all behavior and learning, which includes emotions, creativity, thinking, decision making, and remembering, originate in the brain; however, Tommerdahl (2010) posited that even though there exists



a common goal of developing teaching methods supported by knowledge of the mind and brain, it is impossible to move from the laboratory to the classroom.

If brain functioning is impaired or “taken offline” due to health issues, emotions, negative rumination, or distractions, then the neural networks will not be focused on cognitive efficiency but rather focused on seeking to resolve internal conflicts that inhibit mind and body equilibrium (Friston, 2010; Thayer & Brosschot, 2005). The literature explains that the human brain seeks equilibrium (homeostasis and synchronicity) to achieve cognitive efficiency (Friston, 2010; Hoffman, 2012). Mental disequilibrium over a sustained period of time could become stressful, and cause online EdD and EdS students to make the choice of postponing or withdrawing from their degree programs in order to restore equilibrium; however, this “choice” indicates a departure from self-determined behavior and a completion mindset (Deci et al., 1994; Green & Bowden, 2012; McLachlan & Hagger, 2010; Wolff & Ratner, 1999). The element of choice is related to self-determination theory (Deci et al., 1994; McLachlan & Hagger, 2010) and to Choice Theory, which suggests that individual behavior is the only behavior controllable by the individual (Glasser, 1996). In actuality, the online EdD and EdS program faculty and administration are trying to influence student choice by seeking to institute practices and resources aimed at developing explicit student behaviors, such as competence, sustained persistence, socialization, and intrinsic motivation (Bandura, 1977; CGS, 2010; Deci et al., 1994).

Institutions of higher education are testing and implementing various support services in an effort to lower attrition rates (CGS, 2010; Lovitts, 2005; Pauley et al., 1999; Rockinson-Szapkiw & Spaulding, 2012; Tinto, 2006; West et al., 2011). From an

exit survey of 1,406 PhD students obtaining their doctorates, CGS (2010) identified financial support, mentoring/advising, and family support as the support services these students found most helpful. Other studies have found services such as teaching how the brain works, emotional intelligence training, tutoring, interaction within the macro-environment, student motivation, peer support, listening to music, and time management training to also be beneficial (Bennet & Bennet, 2008; Castro et al., 2011; Gliebe, 2012; Laskey & Hetzel, 2011; Pauley et al., 1999; Tinto, 2006; Tye, 2006; West et al., 2011); however, using neuroeducation as an intervention or teaching technique to enhance perseverance for online EdD and EdS students enrolled in analysis and research courses has not been empirically studied. Pauley et al. (1999) suggested instituting an intervention program to alert students to the significance of motivation, and this motivation is important to online perseverance (Rovai, 2003).

The use of teaching methods, such as neuroeducation, to impact the root cause of an online EdD or EdS student's lack of perseverance in their degree programs could be more beneficial to impacting attrition rates than focusing on extraneous matters (Hoffman, 2012; Tommerdahl, 2010). As colleges and universities reorganize to meet the higher education needs of non-traditional lifelong learners, their advanced degree support services for online students will need to be recalibrated to address changing demographics (age), adult learning needs within the community of inquiry, accessibility to services, and student needs for convenience and flexibility (Beauchamp & Beauchamp, 2012; Kenner & Weinerman, 2011; Rovai, 2003); however, the inter-relationships between basic science and applied research should be considered when developing neuroeducational interventions (Spitzer, 2012). Before educators put into practice

research from neuroscience, they should understand that neuroscience is a descriptive natural science, which aims to discover principles that describe neural structure and function within a given situation (Willingham, 2009), and therefore may not have external validity to the classroom or online setting (Schrag, 2011; Tommerdahl, 2010). The goal of the neuroeducational intervention utilized in this study was to inform students about the factors affecting perseverance in the hope that this information would foster a higher level of perseverance as measured by end-of-course grades, a self-determination survey, and two persistence instruments: a college persistence questionnaire and a chi-square test for persistence.

### **Construct of Perseverance**

As was postulated in Chapter One, this manuscript relates the construct of perseverance through the stages of practical inquiry to brain optimization, mindfulness, emotional intelligence, and self-determination. Research and principles derived from studies about brain optimization, mindfulness, emotional intelligence, and self-determination are highlighted in this chapter to provide empirical evidence for each factor to be considered as integral for perseverance.

### **Brain Optimization**

The research field is ripe with information about learning and mental or cognitive efficiency—the ease of processing new information or retrieving previously stored information from memory (Hoffman, 2012; Miller, 2011; Vekiri, 2002). Mental efficiency relates to balancing cognitive load, and to instructional paradigms that use differentiated instruction (Dewey, 1897; Hoffman, 2012; Neubauer & Fink, 2009). Aristotle postulated hylemorphic dualism to suggest that reality is composed of matter

and form. There is hylemorphic dualism between mental efficiency and brain optimization, i.e., brain optimization supports mental efficiency (Ganzer & Zauderer, 2011; Immordino-Yang & Fischer, 2009; Neubauer & Fink, 2009; Stankov et al., 2006). Although mental efficiency may be made more effective through strategies such as redundancy, dissociation, training in mindfulness, educational technology, and improved instructional materials (Goswami, 2006; Green & Bowden, 2012; Hoffman, 2012; Zheng, McAlack, Wilmes, Kohler-Evans, & Williamson, 2009), learning can also be inhibited by emotional distress, fatigue, hunger, and other distractions managed by the limbic system of the brain, which may have nothing to do with cognitive load (Blomstrand, 2006; Carew & Magsamen, 2010; Harmison, 2011; Roozendall, McEwen, & Chattarji, 2009; Thayer & Brosschot, 2005; Tsaousis & Nikolaou, 2005).

Resiliency and a completion mindset are necessary to meet the demands of the doctoral program (Green & Bowden, 2012; Ivankova & Stick, 2007), and could be improved through the use of neuroeducation to introduce epistemological and emotional support structures and heuristics that are designed to enhance personal knowledge of self-determination, mindfulness, brain optimization strategies, hemisphericity/flexibility, brain efficiency, and emotional intelligence (Banks & Zions, 2010; Burns, Vance Szadokierski, & Stockwell, 2006; Deci & Ryan, 1985; Goleman, 2006; Green & Bowden, 2012; Hoffman, 2012; Mayer et al., 2000; McLachlan & Hagger, 2010; Pauley et al., 1999; Rockinson-Szapkiw & Spaulding, 2012; Shah, 2005; Terrell et al., 2009; West et al., 2011). Resiliency is a Neo-Scholastic methodology, i.e., matters requiring internal logic, which could be enhanced through the use of exercises and training to enhance the intellect, i.e., neuroeducation (Clauss-Ehners, 2008; Knight, 2006).

People have different cognitive abilities, referred to as multiple intelligences (Blair, 2006; Gardner, 2006). From research into cognition, brain optimization, and intelligence, Caine and Caine (1991) developed twelve principles for brain-based educational theory, which further illuminate the role of the brain in intelligence formation. These twelve principles are as follows:

- a) The brain is a parallel processor.
- b) Learning engages the entire physiology.
- c) The search for meaning is innate.
- d) The search for meaning occurs through “patterning.”
- e) Emotions are critical to patterning.
- f) The brain processes parts and wholes simultaneously.
- g) Learning involves both focused attention and peripheral perception.
- h) Learning always involves conscious and unconscious processes.
- i) We have at least two different types of memory: a spatial memory system and a set of systems for rote learning.
- j) We understand and remember best when facts and skills are embedded in natural, spatial memory.
- k) Learning is enhanced by challenge and inhibited by threat.
- l) Each brain is unique. (pp. 80-87)

Online EdD and EdS students are non-traditional adult students, and adults learn and process information differently than children (Knowles, 1977). The neuroeducational intervention used in this study aimed to influence perseverance and resiliency by informing online EdD and EdS students of strategies and information, such as the

information highlighted by Caine and Caine (1991), which could positively impact a completion mindset.

**Adult learning.** Theories and philosophies abound to explain how and why children learn, process, and act on information. Educators and psychologists attempt to relate these theories and philosophies to the developmental stages, the cultural context, the learning styles, and socialization of children (Santo, 2006; Yu, Ryan, Schaie, Willis, & Kolanowski, 2009). Knowles (1977) postulated the theory of andragogy (adult learning theory) to highlight the learning differences between children—as posited by Piaget, Montessori, Froebel, Rousseau, Gibson, Vygotsky, and Bandura—and adults. Through his post-positivist (empirical research and scientific method) approach, five principles that characterize the unique learning attributes of adult learners were identified: adults are self-directed, have an extensive depth of experience, ready to learn, intrinsically motivated, and they are task centered. Although useful in developing interventions for adults, Knowles theory has a few limitations that brain-based research has illuminated.

Knowles principles make a generalization that relates adults to being autonomous. Unfortunately many adults have “learned” behaviors or lifestyles that alter this orientation, and researchers have found that most adults are “externally” motivated and they often act impulsively, irrationally, or out of habit (Hechter & Kanazawa, 1997). When the pre-frontal cortex is taken offline for any reason, an autonomic imbalance occurs, which may negatively affect executive, social, affective, attentional, and motivational behavior (Thayer & Brosschot, 2005). Heteronomy (external locus of control), improper nutrition, lack of physical exercise, and negative emotions are examples of situations that may impact brain optimization causing ineffective neuronal

operations (Bar-on et al., 2003; Caine & Caine, 1991; Costa & Kallick, 2000; Gardner, 2006; Igase, 2010; Korzeniewski, 2011; Ryan & Deci, 2006; Stankov et al., 2006; Sternberg, 2003; Taggart & Torrance, 1984; Thayer & Brosschot, 2005). Since these mitigating factors to adult learning may inhibit peak performance, several educators have proposed a brain-targeted teaching model (Friedlander et al., 2011; Hardiman, 2010; Immordino-Yang & Fischer, 2009), and researchers are finding positive results from interventions designed to improve brain functioning (Jaeggi et al., 2008; Kenner & Weinerman, 2011; Lee & Hung, 2009; Sternberg, 2008), and to influence academic performance, self-determination, and persistence (Banks & Zions, 2010; Darowski, Helder, Zacks, Hasher, & Hambrick, 2008; Lee & Hung, 2009; Pool & Qualter, 2012; Uncapher & Rugg, 2009; Uyangor, 2012) to include online interventions (Hardy et al., 2011; Rockinson-Szapkiw, 2011; Rovai, 2002; Rovai, 2007; Santo, 2006).

The importance of proper brain functioning to peak performance, learning and memory, well-being, emotional intelligence, perceived efficacy, self-determination, and persistence has been confirmed and well documented (Anderson, 2010; Banks & Zions, 2010; Bennet & Bennet, 2008; Cabeza, Ciaramelli, Olson, & Morris, 2008; Caine & Caine, 1991; Deary et al., 2010; Fernstrom, 2005; Friston, 2010; Hardy et al., 2011; Harmison, 2011; Heatherton, 2011; Jaeggi et al., 2008; Jenkins & Mitchell, 2011; Kennedy & Shapiro, 2009; Mahncke et al., 2006; Rabipour & Raz, 2012; Ryan & Deci, 2000; Ryan & Deci, 2006; Ryan & Deci, 2008; Ryan & Niemiec, 2009; Ryback, 2006; van Merriënboer & Sweller, 2010). The study of the brain, referred to as neuroscience, has evolved to a stage of combining neuroimaging with empirical research to better understand how adult learning, behavior, and intelligence interact at the cellular and

synaptic level (Cooper, 2005; Korzenieqski, 2011; LeDoux, 2002; Li et al., 2009; Meltzer, 2007; Stankov et al., 2006; Thayer & Brosschot, 2005).

The adult brain changes over the lifespan based on new experiences to sensory data (risk/reward operations) in a process referred to as neuroplasticity (Anderson, 2010; Yu et al., 2009). Each new experience within ecological situations alters existing neuronal pathways in the pre-frontal cortex and limbic system of the brain resulting in the creation of unique individual intelligences (Blair, 2006; Deary et al., 2010; Gardner, 2006; Sporns, 2011). Higher-order decision making, referred to as executive function or fluid intelligence (Blair, 2006; Meltzer, 2007; Yu et al., 2009), has been related to reflective neuronal activity in the pre-frontal cortex and limbic system, where cells interact with synaptic signals (cues) of task demands and tune responses based on these demands (Blair, 2006; Friston, 2010; Gailliot, 2008; Meltzer, 2007; Ryan & Deci, 2006; Thayer & Brosschot, 2005). The age and ontological experience of adults shape their brain's response to sensory data, and serve as "powerful roles" in outward behavior (Borges et al., 2010; Diaz, 2002; Nelson, de Haan, & Thomas, 2006; Rogers et al., 2007; Salthouse et al., 2004; Yu et al., 2009). This sensory data (conscious and unconscious) can engage memory retrieval and direct behavioral responses, as well as modulate the relative significance of the responses (Bar-on et al., 2003; D'Anci, Watts, Kanarek, & Taylor, 2008; Kennedy & Shapiro, 2009). Mata, Schooler, and Rieskamp (2007) discovered that people, especially non-traditional adults, often use learned (intrinsic) strategies in situations requiring self-regulation, a key component of being self-determined (Deci et al., 1991). Bandura (1977) related this process to self-efficacy. Perceived efficacy and self-regulation are important factors for cognitive presence



(Garrison, 2003). Cognitive presence, operationalized through the four stages of practical inquiry, may be improved through an understanding of information processing.

**Information processing.** Two constructs related to information processing theory and practical inquiry are authentic learning, which has three components: higher order thinking, depth of knowledge and understanding, and connectedness to the real world (Anctil, 2006; Blair, 2006; Garrison, 2003), and the free-energy principle [a coherence theory], which suggests that when the brain is optimized (not distracted), it is in equilibrium [homeostasis] and functions more efficiently (Bennet & Bennet, 2008; Blair, 2006; Friston, 2010; Garrison, 2003; Thayer & Brosschot, 2005; Vallerand, 2000). Information processing theory describes how sensory data, such as task demands, efficiently connect with mental strategies, attention, memory, and executive function (Friston, 2010; Miller, 1994; Miller, 2011; Thayer & Brosschot, 2005), and this process is often conceptualized as crystalized and fluid intelligence (Blair, 2006). As sensory data is processed (fluid intelligence), the information is stored as a new neural pathway or recoded to previous memory (crystalized intelligence), which is similar to a computer processing new information into an existing file (Miller, 1994).

Differences in adult information processing speed appear to be due to the topological properties associated with the brain's neural networks or due to inhibitors impacting normal operations (Blair, 2006; Salthouse et al., 2004; Thayer & Brosschot, 2005). These differences were studied by Li et al. (2009) using neuroimaging: Magnetic Resonance Imaging (MRI) scanning, a technique for brain imaging and mapping. The study ( $n = 79$ ; mean age 23.8) found evidence to support that individual differences on the Wechsler Adult Intelligence Scale tests were associated with brain network topology.

High local clustering of connections between neighboring nodes and short path lengths between pairs of nodes reflected fewer signal processing steps between brain regions, indicating higher efficiency of transfer [higher intelligence]. The speed of information processing has been studied by several researchers as a construct to measure intelligence (Gardner, 2006; Li et al., 2009; Salthouse et al., 2004; Sternberg, 2003). Specific neuroeducational training has been empirically found to enhance the topological properties affecting information processing speed, working memory operations, persistence, social competency, and emotional intelligence (Banks & Zionts, 2010; Erickson et al., 2011; Goleman, 2006; Harmison, 2011; Jaeggi et al., 2008; Olesen, Westerberg, & Klingber, 2004). Novelty, attentional, repetition, and other types of neuroeducation have been shown to be effective in improving fluid intelligence (Cabeza et al., 2008; Cooper, 2005; Fritsch et al., 2007; Mahncke et al., 2006). Jaeggi et al. (2008) conducted a study on improving fluid intelligence with training on working memory. The authors concluded that fluid intelligence is complex and allows us to adapt thinking to new problems or situations. Using a “dual n-back” task training methodology, their study ( $n = 69$ ;  $M$  age = 25.6) proved successful in increasing working memory capacity and information processing ability. Bennet and Bennet (2008) found in their research that music fostered hemispheric synchronization resulting in information-processing efficiency and improved learning.

Another information-processing efficiency technique can be found in Paivio’s dual-coding theory, which postulates that images become a second kind of memory code to enhance textual transfer (Vekiri, 2002). Findings from studies using graphic organizers as an instructional differentiation show that graphical representations are computationally

efficient when they minimize the processing required for their interpretation (Vekiri, 2002). Robinson and Kiewra (1995) found in a university study ( $n = 111$ ) that graphic organizers were superior to outlines for improved learning. This information is important when preparing instruction to enhance brain functioning in adults, and can support transformative learning theory, which is described as a rational and metacognitive process of evaluating current knowledge against new learning in contextual factors (Mezirow, 2006). The neuroeducational intervention designed for this study was constructed from a study of existing empirical research. Additional factors that can positively or negatively influence information processing speed are the level of physical activity and healthy nutrition.

**The influence of exercise and nutrition on brain optimization.** Two additional factors that have been demonstrated to impact brain optimization are exercise and nutrition. The majority of advanced degree support services relate to assisting students with technology, socialization, the dissertation process, faculty interaction, program financing, and emotional support (CGS, 2010; Rockinson-Szapkiw et al., 2010; Rovai, 2003; Tinto, 2006; West et al., 2011), which do not include teaching lifestyle factors. The human brain uses up to 30% of a person's energy at rest and even more during problem solving (Turner, 2011). The brain requires the synthesis of glucose and certain nutrients to achieve optimal brain functioning, and individuals who do not consume the appropriate amounts of these energy producing nutrients will experience inhibited mental functioning (Fernstrom, 2005; Igase et al., 2010; Kamphuis & Wurtman, 2009; Turner, 2011; Wurtman, Cansev, Sakamoto, & Ulus, 2010).

Advances in neurobiology have revealed that food-derived signals through the digestive track influence energy metabolism, synaptic plasticity (learning and memory), and cognition (Gomez-Pinilla, 2008). D'Anci et al. (2008) tested participants on cognitive tests ( $n = 19$ ) using a 2 (diet: low-carbohydrate and ADA) x 4 (test sessions) repeated measures mixed-factor design. Body mass index did not vary among the participants. The participants were subjected to four procedures: a food paired associates memory task, a digit span task, a visuospatial memory task, and a vigilance attention task. Results indicated that the low carbohydrate diet negatively impacted cognitive performance, and the participants receiving higher doses of glucose had the higher performance. If carbohydrates and proteins are not balanced in meals, or if meal frequency is limited, the ratio of plasma chemicals that inhibit or excite alertness, cognition, and memory formation and retrieval may be altered, which can impact academic performance (Carlson et al., 2007; Markus, Olivier, & de Haan, 2002; Markus et al., 2005; Wurtman et al., 2003). Gailliot (2008) reviewed fifty studies and determined that executive functioning relies on glucose reserves to maintain efficient processing to include autonomous behavior. The brain operates at peak performance when it has a steady supply of glucose (Igase, 2010; Turner, 2011). Although it is beyond the scope of this paper to discuss the cellular interaction with chemicals and neurotransmitters, such as norepinephrine, these interactions can actually strengthen and increase synaptic structures, which enhances learning and memory (Blomstrand, 2006; Fernstrom & Fernstrom, 2007; Tully & Bolshakov, 2010; Wurtman et al., 2003). Norepinephrine increases glucose levels in the blood stream, and modulates the synaptic strength of

memory formation in the hippocampus (Tully & Bolshakov, 2010), the part of the brain that encodes data from working memory.

Exercise is another factor that can either enhance or inhibit neurocognitive performance (Ainslie et al., 2008; Carew & Magsamen, 2010; Smith et al., 2010). Kramer, Erickson, and Colcombe (2006) reported an increased interest over the past decade in physical activity on the cognitive vitality of adults. Their review of the literature highlighted a longitudinal study ( $n = 5,925$  women), which found that performance on the Mini Mental State Examination improved with increased exercise. Winter et al. (2006) found in their study ( $n = 30$ ;  $M age = 22$ ) that vocabulary learning was twenty percent faster after intense physical exercise. In another meta-analysis ( $n = 2,049$ ) reviewing the impact of aerobic exercise conducted by Smith et al. (2010), modest improvements were found in attention and processing speed, executive function, and memory.

Energy, in the form of glucose, is delivered to the brain through blood flow, and the velocity of this blood flow, which is a positive effect of exercise, can enhance peak performance and improve information processing speed and memory (Ainslie et al., 2008; Vaynman & Gomez-Pinilla, 2006; Winter et al., 2006). The increased velocity of blood flow is characterized by cardiovascular fitness and improved cognition (Colcombe et al., 2004; Hillman et al., 2008; Vaynman, Ying, & Gomez-Pinilla, 2004). The size of the hippocampus and memory improvement can be impacted through exercise training (Erickson et al., 2011). Habitual physical activity can improve academic performance and well-being (Aarts, Paulussen, & Schaalma, 1997; Kramer et al., 2006).

The brain optimization research above demonstrates that neuroeducational interventions have been successful strategies for increasing information processing speed, working memory, attitudes toward fitness and nutrition, and for improving peak performance. Relating the importance of brain optimization to online EdD and EdS students was a goal of this study's neuroeducational intervention. Each week of the intervention, tips on brain optimization were highlighted (see Instructor Guide in Appendix E) to foster student awareness of the importance of brain optimization. The General Causality Orientations Scale instrument was used within this study to assess the effect of this study's intervention on the student volunteers' loci of causality.

### **Mindfulness**

Mindfulness is self-awareness of one's present thoughts, emotional state, and environment, and mindfulness interventions have positively improved cognitive presence and emotion (Akyol & Garrison, 2011; Tang & Posner, 2009). A person's attention is very selective, and this assertion is important to understanding why some people are able to be inundated with sensory information without distraction or cognitive overload (Darowski et al., 2008; Ryback, 2006; Tompkins, 2007). Organizing sensory data may require a mindful focus on anything that puts the brain into disequilibrium (Friston, 2010; Thayer & Brosschot, 2005), and the ability to ignore or control the processing of distracting information may underlie many individual differences in impulse control and in cognitive and emotional intelligence (Bertsch et al., 2009; Cabeza et al., 2008; Darowski, et al., 2008). Dysfunctional impulsivity has been related to deficits in resiliency, attention, reflection, and insensitivity to consequences (Clauss-Ehlers, 2008; Crews & Boettiger, 2009; Luthar et al., 2000b). The alerting, orienting, and executive

attention systems within the brain enable mindfulness (Rabipour & Raz, 2012; Ryback, 2006), and training on this trilogy may benefit online EdD and EdS students when working through the phases of practical inquiry: triggering event, exploration, integration, and resolution (Darabi, Arrastia, Nelson, Cornille, & Liang, 2011; Garrison, 2003).

Online EdD and EdS students should plan throughout their degree programs to use mindfulness as an adaptive heuristic (Darabi et al., 2011; Green & Bowden, 2012; Lovitts, 2005). The first phase of practical inquiry begins with an interpretation of the learning environment to include the shared nature of coursework, the content, and the ability to inquire about the content (Darabi et al., 2011; Garrison, 2003; Garrison et al., 2001; Garrison and Cleveland-Innes, 2005).

The conceptual framework presented in this literature review is that by using a neuroeducational intervention as a cognitive behavioral strategy, adult students will become mindful of factors that could enhance or inhibit their perseverance toward their EdD or EdS designation (Hardy et al., 2011; Rabipour & Raz, 2012). Mindfulness, as a neuroeducational strategy, has been found to be effective with students as a stress reduction strategy and as a mediator against negative forms of rumination, i.e., tendencies to self-reflect on past failures or failings thereby interfering with problem-solving ability (Garrison and Cleveland-Innes, 2005; Gohm, Corser, & Dalsky, 2005; Goswami, 2006; Rabipour & Raz, 2012; Shapiro, Oman, Thoresen, Plante, & Flinders, 2008). Mindfulness is important to social and emotional regulation, as the neural synapses of executive attention occur within the brain's dopaminergic system: a system that influences focus, inspiration, intuition, enthusiasm, and joy (Rabipour & Raz, 2012). Hardy et al. (2011)

examined a volunteer group of adults ( $n = 23$ ;  $M$  age = 54) using a pretest/posttest design, and found brain training on visual attention improved working memory. Uncapher and Rugg (2009) also used brain training to study selective attention ( $n = 19$ ;  $M$  age = 21), and discovered that selective attention modulates the magnitude of cortical regions engaged by different aspects of an event. Gohm et al. (2005) examined college freshman ( $n = 158$ ;  $M$  age = 18.3), and found clarity—mindfulness—in high correlation to emotional intelligence.

The elements of mindfulness—self-awareness, critical thinking, and the ability to exercise cognitive control (self-regulation)—influence vital aspects of human adaptability and represent intra/interpersonal intelligence (Deci et al., 1991; Tang & Posner, 2009; Thayer & Brosschot, 2005), especially in online environments (Garrison, 2003; Santo, 2006; Vaughan & Garrison, 2005). Shapiro et al. (2008) posited that mindfulness consists of three inter-related components: intention (motivation), attention (focus), and attitude (affectionate attention), which are also components necessary for cognitive presence (Darabi et al., 2011; Garrison, 2003; Rovai, 2007). Since interventions using mindfulness reduce negative forms of rumination and enhance self-efficacy and self-determination, then efficacy expectations—conviction that a given behavior will achieve an outcome—should enhance perseverance (Bandura, 1977; Gohm et al., 2005).

Other factors that may influence mindfulness in decision making and persistence toward successful task completion are creativity and mental flexibility (Caine & Caine, 1991; Costa & Kallick, 2000; Costa, 2001; Gardner, 2006; Garrison, 2003; Taggart & Torrance, 1984; Treffinger et al., 2007; Vallerand, 2000; Wolff & Ratner, 1999). Flexibility or brain efficiency is related to brain hemisphericity [hemispheric



lateralization], often called brain coherence (Garrison, 2003; Griffiths et al., 2011), or the ability to freely switch between brain hemispheres, where the left hemisphere generally responds to language and the right hemisphere to spatiality (Anderson, 2010; Gier et al., 2010; Stankov et al., 2006; Taggart & Torrance, 1984). Thinking abstractly and flexibly are important attributes of creativity, decision making, and problem solving (Duckworth et al., 2007; Friedlander et al., 2011; Szirony et al., 2008; Treffinger et al., 2007), and represent higher-order thinking or neo-cortical and pre-frontal cortex operations (Blair, 2006; Meltzer, 2007; Yu et al., 2009). Lovitts (2005) posited creativity as an attribute of success, and listed six personal psychological and social resources involved in creative output: intelligence, knowledge, thinking styles, personality, motivation, and environmental context, which interestingly link to EI, brain functionality, and mindfulness. Since doctoral students have trouble transitioning from course work to independent research (Glatthorn & Joyner, 2005; Lovitts; 2005), and faculty cannot predict who is at risk of not making the transition based solely on a student's ability as a course-taker (Lovitts, 2005), then neuroeducation utilizing creativity assessments, such as the VIEW instrument used in this research study, could be beneficial to enabling at risk students to become mindful about thoughts and activities that reduce energy.

Hermanowicz (2006) postulated that all students should be considered at risk.

Successful degree attainment will require online EdD and EdS students to persevere through adversity and distractions, which will require the use of heuristics, such as mindfulness, to enhance self-awareness, problem-solving capability, and goal directedness (Green & Bowden, 2012; Lovitts, 2005; Rovai, 2002; Ryback, 2006; Shah, 2005; Treffinger et al., 2007). The College Persistence Questionnaire, general causality

of orientations scale survey, and end-of-course grades were used in this study to evaluate locus of causality, academic conscientiousness, academic integration, degree commitment, institutional commitment, social integration, and academic efficacy, which are factors related to mindfulness.

### **Emotional Intelligence (EI)**

Gliebe (2012) postulated that institutions of Christian higher education must teach emotional intelligence education. Although empirical research has confirmed that students' emotional management strategies (mindfulness, self-confidence, goal-setting, problem-solving skills, and stress management) are predictors of health, well-being, and goal-directedness enabling them to adapt and overcome performance obstacles, emotional intelligence theory (EI) will require more evidence-based research before a consensus among researchers is reached on how to apply teaching principles (Cherniss, Extein, Goleman, & Weissberg, 2006; La Guardia, Ryan, Couchman, & Deci, 2000; Mayer, Salovey, Caruso, & Sitarenios, 2001; Pool & Qualter, 2012; Zeidner, Roberts, & Matthews, 2008).

Emotional intelligence or emotional coherence is different from innate personality factors, as it engenders and enhances cognition and health (Mlonzi & Strumpfer, 1998), and can synchronize personal differences, such as religious beliefs, with social competence (Thagard, 2005). Mayer et al. (2001) postulated that emotional intelligence begins with actual, remembered, and imagined feelings around relationships, and this construct is manifested in four areas:

- a) accuracy in perceiving emotions,
- b) accuracy in using emotions to facilitate thought,

- c) accuracy in understanding emotions, and
- d) accuracy in managing emotions in a way that enhances personal growth and social relations. (p. 234)

Mayer et al. (2000) conducted two studies ( $n = 503$  adults;  $n = 229$  adolescents) using the Multifactor Emotional Intelligence Scale (MEIS), and discovered that EI, as measured by this instrument, meets the criteria of a standard intelligence.

Emotional intelligence may be defined as the unique individual responses to processing and managing emotions enabling successful functioning in everyday life (Baron et al., 2003; Freudenthaler, Neubauer, & Haller, 2008), and there are four dimensions of emotional mastery: self-awareness, self-management, social awareness, and relationship management (Goleman, 2011). Successful leadership skills and self-efficacy begin with the dimension of self-awareness (Bandura, 1977; George, 2011). Deficits in emotional intelligence lead to inaccurate judgment in decision making related to relationships (Bar-on et al., 2003).

Lane et al. (2009) found in their study ( $n = 54$ ;  $M$  age = 21.7) that the use of individual self-talk and imagery as emotional management strategies were correlated with theory of mind, i.e., perception and appraisal of others' emotions and their ability to regulate these emotions (Kemp, Despres, Sellal, & Dufour, 2012). Spence et al. (2004) concluded from their study of undergraduate college students ( $n = 95$ ) that trait EI and goal self-integration are both related to emotional well-being, i.e., salutogenesis. Brackett, Mayer, and Warner (2004) studied college students ( $n = 330$ ) and found a positive relationship between emotional intelligence and decision making. Pool and

Qualter (2012) used a teaching intervention to successfully elevate university students' emotional intelligence and self-efficacy ( $n = 134$ ;  $M$  age = 23).

When reacting to adversity or an obstacle, such as a feeling of helplessness or hopelessness in goal achievement or social situations (Haefel et al., 2008), the tendency is to “downshift” rather than to invoke higher order reasoning and decision-making strategies, which are integral to emotional intelligence (Caine & Caine, 1991; Hermann, 1991; Thayer & Brosschot, 2005). Stress and negative rumination can impair the functioning of the hippocampus (involved in information processing and short-term memory) causing students to lose their focus or to become depressed (James, Bore, & Zito, 2012; Wolff & Ratner, 1999); however, positive emotional strategies such as exercise, meditation, listening to music, and social interaction can alleviate stress, enhance learning, and influence hemispheric synchronization (Banks & Zionts, 2010; Bennet & Bennet, 2008; Carew & Magsamen, 2010; Travis et al., 2008). Travis et al. (2008) used a randomized controlled trial to prove the positive effects of transcendental meditation practice on brain functioning and stress reactivity in college students ( $n = 50$ ;  $M$  age = 22.4).

A goal of online learning is to have instructors and students involved in critical discourse to achieve cognitive presence (deep learning) (Akyol & Garrison, 2011; Darabi et al., 2011; Garrison & Cleveland-Innes, 2005; Santo, 2006); however, in online asynchronous environments, there is an interaction gap that interferes with emotional transference, which may inhibit cognitive presence (Vallerand, 2000). The need for cognitive presence—the extent to which learners construct and confirm meaning through sustained reflection and discourse in a community of critical inquiry—in online

environments has been noted by researchers (Garrison et al., 2001; Garrison & Cleveland-Innes, 2005; Rockinson-Szapkiw & Spaulding, 2012; Vallerand, 2000). The exploration phase of practical inquiry includes an emotional component (Akyol & Garrison, 2011; Darabi et al., 2011), where students establish an opinion based on their attitude, personal views, beliefs or judgments. As professors relate experiences to situational environments, students must use critical thinking to make ethical and moral judgments about these experiences. This emotional intelligence ability is distinct from IQ or personality traits (Cherniss et al., 2006), and understanding others—referred to as theory of mind—is an important attribute of emotional intelligence (Kemp et al., 2012). EI can be measured through self-report surveys such as the EQ-i, MEIS, and the MSCEIT. Each of these instruments has been in circulation for some time. The neuroeducational intervention in this study utilized weekly self-report measures to emphasize connectedness and empathy, which affect social presence in the community of inquiry.

Working through emotional disequilibrium relates to the process of emotional management, which requires higher-order thinking and directly influences connectedness, competence, mindfulness, and cognitive presence (Darabi et al., 2011; Garrison, 2003; Green & Bowden, 2012; Rockinson-Szapkiw & Spaulding, 2012; Vallerand, 2000). Gliebe (2012) posited five initiatives to foster emotional intelligence (EI) in Christian higher education: teach faculty EI skills; incorporate EI into lessons; provide EI training for new students; incorporate EI teaching into spiritual formation; and teach EI to mental health professionals. MacCann et al. (2010) found in their study ( $n = 159$ ,  $M = 23.4$  years of age) of adult college students that emotional management predicted GPA. The study

used three measures of coping to correlate with GPA. Parker et al. (2004) reported from their study ( $n = 372$ ,  $M = 19.3$  years of age) that emotional management positively correlated to GPA.

The design for this research study used a neuroeducational instructional strategy which incorporated a multimedia lesson on emotional intelligence in week seven of the seven-week intervention. This instructional strategy is designed to elevate knowledge of positive thinking and emotional awareness in order to help online EdD and EdS students with self-management toward the end of their research and analysis course. Emotional intelligence was assessed using the General Causality of Orientations Scale survey and the College Persistence Questionnaire to measure locus of causality, institutional commitment, social integration, advisory satisfaction, financial strain, and collegiate stress.

### **Self-Determination**

Self-determination theory related to education is primarily interested in promoting students' interest in learning, in fostering value in their education, and in developing perceived self-efficacy (Deci et al., 1991), and is an organismic-dialectical theory that pictures human nature as proactive but influenced by the social context (Deci et al., 1994). The theory promotes greater self-determination and seeks to explain three loci of causality (autonomous, controlled, and impersonal) orientations; and it examines empirically how the processes and context of rewards, directives, praise, and information feedback enhance self-regulation, well-being, and outcomes (Deci et al., 1991; Gagne, 2003; Ryan & Deci, 2008).

Self-determination theory recognizes that emotion and reason are sometimes at odds (de Oliveria-Souza, Moll, & Grafman, 2011), and highlights two general classes of motivated behaviors: those that are self-determined (integration), and those that are controlled (introjection) (Deci et al., 1994). From the empirical process, Ryan and Deci (2000) inductively determined three autonomous elements—competence, relatedness, and integration—that tend to be essential for self-determination, constructive social development, and personal well-being. The epistemological components of preferring positive attitudes, enhanced performance, and personal well-being have key roles in self-determination (Ryan & Deci, 2000). Each of the three loci of causality orientations are discussed below:

**Autonomous orientation.** Autonomy is a behavior that results from coordination with the brain's neurocircuitry, i.e., the *pre-frontal cortex*, where higher order thinking takes place; the *amygdala*, where emotional cues are processed; and the *hippocampus*, where working memory is encoded into long-term memory (Ryan & Deci, 2006). A person with a high autonomy orientation tends to self-endorse and display enhanced self-initiation, seek out a supporting social structure, and take responsibility for choices. Deci and Ryan (1985) empirically found that an autonomous orientation promotes self-determined functioning. Diaz (2002) discovered that student independence (autonomy) favors success in online programs. Deci and Ryan (1985) indicated that an individual with an autonomous orientation will rate high on competence, relatedness, and self-initiation; however, there is skepticism about the assumption that individuals calculate the expected consequences of options and then choose and act on the best one (Hechter & Kanazawa, 1997; Hoogstad, 2008).

The level of self-integration in goal directedness varies among individuals (Hoogstad, 2008; Spence, Oades, & Caputi, 2004), and can also affect their well-being and perceived competence (Sheldon, Ryan, & Reis, 1996). Self-integration relates to autonomy, a term used for self-regulation, which enables a person to defer gratification in the short-term to achieve desired outcomes (Bussing, Girke, Heckmann, Schad, Ostermann, & Kroz, 2009; Neal & Carey, 2005; Ryan & Deci, 2006). An autonomous orientation can be supported by giving people choices and encouragement for taking personal initiative (Gagne, 2003), which was a strategy within the neuroeducational intervention designed for this study. Gagne (2003) reported that a lack of autonomous support could create negative outcomes such as attrition in educational settings. Baltes and Staudinger (2000) correlated autonomous behavior to wisdom suggesting that wisdom is a cognitive and motivational metaheuristic. The concept of self-direction and independence is a hallmark of adult learning, and this concept is assumed for non-traditional students enrolled in distance education (Rovai, 2003). Students lacking in self-direction and self-discipline may be less likely to persist in online courses (Rovai, 2003).

**Controlled orientation.** The opposite of autonomy is heteronomy or controlled regulation, which means that an individual is externally motivated toward a goal by emotional dependency, an offer of rewards, pressure, threat of a punishment, or a habitual response (Aarts & Dijksterhuis, 2000; Deci & Ryan, 1985; Deci et al., 1991; Hoogstad, 2008). A controlled orientation relates to emotional dependency, as those with this orientation tend to rely on controlling events such as deadlines or surveillance in order to become motivated (Deci & Ryan, 1985), and those with a controlled orientation lack adequate self-efficacy (Bandura, 1977; Hoogstad, 2008).



**Impersonal orientation.** Students with this orientation will see tasks as being too difficult, and see outcomes as being independent of effort (Deci & Ryan, 1985). This feeling of hopelessness relates to Hopelessness Theory, which examines the complex disorder resulting from the interaction of environmental, cognitive, motivational, and biological risk factors (Haefel, Abramson, Brazy, & Shah, 2008). Haefel et al. (2008) in their study of undergraduates ( $n = 248$ ) found that individuals who experienced a decrease in goal-directed behavior had higher levels of depressive symptoms.

Self-management strategies to mitigate hopelessness and loss of goal-directedness are mindfulness, the use of exercise, planning activities, such as creating “to do” lists or writing out a person’s goals, rest, and meditation (Banks & Zionts, 2010; Hillman et al., 2008; Ryback, 2006; Shah, 2005; Travis et al., 2009). When emotionally dependent behavior is habitual, behavioral responses are automatically activated; however, planning can mitigate automatic responses (Aarts & Dijksterhuis, 2000; Shah, 2005). Exercise can also be used to mitigate an impersonal orientation. In a meta-analysis involving 58 randomized trials ( $n = 2,982$ ) conducted by Rethorst, Wipfli, and Landers (2009), exercise was found to have a large effect size as an anti-depressive activity. Exercise has been shown to positively correlate with controlling emotions, as a mood regulation strategy, and to positively correlate with higher scores for emotional intelligence (Ainslie et al., 2008; Erickson et al., 2011; Colcombe et al., 2004; Smith et al., 2010; Solanki & Lane, 2010).

Knowledge about the human brain and how it’s functioning impacts self-determination could be beneficial to online EdD and EdS student perseverance toward their advanced degrees (Friedlander et al., 2011; Green & Bowden, 2012; Diaz, 2002;

Hardiman, 2010; Immordino-Yang & Fischer, 2009; Ryback, 2006; Tye, 2006; West et al., 2011). Researchers have suggested that a neuroeducational curriculum designed to promote emotional resiliency and a sense of coherence—defined as the ability to perceive stressors as manageable, meaningful, and comprehensible—should be an integral part of school curriculum (Banks & Zions, 2010; Brockelman, 2009; Castro et al. 2011; Wolff & Ratner, 1999).

Self-determination theory can be modeled to become a successful form of intervention in graduate education by teaching the benefits of an autonomous orientation, i.e., self-endorsement of personal behavior or knowledge of internal locus of control, as a self-regulation strategy for goal performance, persistence, affective experience, and well-being (Brockelman, 2009; Ryan & Deci, 2006; Ryan & Deci, 2008; Ryan & Niemiec, 2009). The General Causality Orientations Scale (GCOS), which was utilized in this study, measures self-determination orientations: autonomous, controlled, and impersonal (Deci & Ryan, 1985). In addition, the College Persistence Questionnaire was used to measure academic motivation and academic integration.

### **Conclusion**

As this literature review has highlighted, online EdD and EdS student awareness of the importance of brain optimization, mindfulness, emotional intelligence, and self-determination is important for the development and maintenance of a completion mindset, resilience, and perseverance (Duckworth et al., 2007; Lovitts, 2005; MacCann et al., 2010; Palmer, Donaldson, & Stough, 2002). Healthy emotions, flexible thinking, proper nutrition, and aerobic exercise are necessary for the brain to operate at peak

performance (Allen, 2012; Fernstrom & Fernstrom, 2007; Garrison, 2003; Kamphuis & Wurtman, 2009; Lovitts, 2005; Stine-Morrow, Parisi, Morrow, & Park, 2008).

The purpose of this research study was to examine the effect of a neuroeducational intervention, which provided instruction on brain optimization, mindfulness, emotional intelligence, and self-determination on a volunteer convenience sample of EdD and EdS students enrolled in online research and analysis courses at a private central Virginia university to determine if the intervention would have a positive effect on the level of perseverance through the stages of practical inquiry when compared to a control group. Neuroeducation is a new form of human learning that recognizes the role of experience, brain optimization, lifestyle, and context over a person's lifetime to the proper functioning of neural pathways, which enable the whole person to express knowledge skills, attitudes, values, emotions, beliefs, and wisdom in affect situations (Jarvis, 2006).

The goal of this study was to demonstrate that the treatment group's multivariate and mean scores would be higher than those of the control group. Tips and videos on brain optimization, mindfulness, emotional intelligence, and self-determination were components of the neuroeducational intervention utilized in this study. At the end of the seven-week intervention, four assessments were made to determine the effectiveness of this intervention:

- a) End-of-course grades were used to assess mindfulness, scholastic conscientiousness, and degree of success in the stages of practical inquiry.
- b) The GCOS was used to assess the locus of causality of the students.

- c) The CPQ was used to assess ten attributes related to perseverance: institutional commitment, degree commitment, academic integration, social integration, advising effectiveness, collegiate stress, financial strain, scholastic conscientiousness, academic efficacy, and academic motivation.
- d) A non-parametric chi-square distribution was used to assess course persistence between the control group and the treatment group.

As reported above, there is a gap in the literature between research and practice, and there is a lack of studies relating neuroeducational interventions to online student perseverance. A goal of this study was to examine the effect of neuroeducation relating brain optimization, mindfulness, emotional intelligence, and self-determination to the perseverance level for online EdD and EdS students enrolled in research and analysis courses, as compared to a control group who received no instruction. Christian and other institutions of higher education may find axiological value in offering this type of training to online students, and the use of this service could potentially reduce online EdD and EdS student attrition rates.

## **CHAPTER THREE: METHODOLOGY**

This research study was designed to evaluate the effect of an intervention on EdD and EdS perseverance through the stages of inquiry for online research and analysis courses. The independent variable was a neuroeducational intervention with two levels (a treatment group and a control group). The intervention consisted of seven weekly multi-media modules about brain optimization, mindfulness, emotional intelligence and self-determination, and included relaxation activities, words of encouragement, a creativity survey, and a weekly online self-report instrument. The dependent variables were end-of-course grades, a self-determination survey, a college persistence questionnaire, and a chi-square course persistence 2 x 2 contingency distribution.

Chapter three will inform the reader about the volunteer participants, setting, instrumentation, procedures, research design, and data analysis associated with this study.

### **Research Design**

The research design selected for this study was an experimental design (a randomized subjects, control group, posttest only), which was used to measure the magnitude of the effect for these instructional methods. The goal of the study was the enhancement of online EdD and EdS perseverance and resilience by using specific neuroeducation to inform students about brain optimization, mindfulness (self-awareness and self-monitoring), emotional intelligence, and self-determination. An experimental design was chosen as it is considered to be one of the most rigorous research designs for research involving a treatment and evaluation (Gall, Gall, & Borg, 2007). There were three steps involved in this type of study:

- a) Randomly assign research participants to the experimental and control groups.

- b) Administer the treatment to the experimental group and no treatment or an alternative treatment to the control group.
- c) Administer the posttest to both groups. (Gall et al., 2007, p. 409)

A posttest-only design was used to control for the possibility that a pretest may impact the results of the study. A pretest could become a testing threat to internal validity by sensitizing the groups to the subject matter of the study (Gall et al., 2007). Group equivalence was assumed due to randomization. This randomization took place before the experiment began and was an internal validity technique used to control for extraneous variables such as preexisting differences (Fraenkel & Wallen, 2006; Gall et al., 2007; Howell, 2011). The random sequence generator provided through the website, [www.random.org](http://www.random.org), was used to randomize the sample into two groups.

### **Research Questions and Hypotheses**

The following are the research questions with their null research hypotheses and their alternative hypotheses:

#### **Research Question One and Hypotheses**

Will the online neuroeducational intervention have a significant effect on online EdD and EdS students' research and analysis end-of-course grades?

**H<sub>01</sub>:** There will be no effect on end-of-course instructor-provided grades for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A1</sub>:** There will be a significant effect on end-of-course instructor-provided grades for online EdD and EdS students enrolled in research and analysis courses after

receiving a seven-week online neuroeducational instructional module when compared to a control group.

### **Research Question Two and Hypotheses**

Will the online neuroeducational intervention have a significant effect on online EdD and EdS students' self-determination scores?

**H<sub>02.1</sub>:** There will be no effect on composite self-determination scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A2.1</sub>:** There will be a significant effect on composite self-determination scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>02.2</sub>:** There will be no effect on impersonal orientation for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A2.2</sub>:** There will be a significant effect on impersonal orientation for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>02.3</sub>:** There will be no effect on controlled orientation for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A2.3</sub>:** There will be a significant effect on controlled orientation for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>02.4</sub>:** There will be no effect on autonomy orientation for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A2.4</sub>:** There will be a significant effect on autonomy orientation for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

### **Research Question Three and Hypotheses**

Will the online neuroeducational intervention have a significant effect on online EdD and EdS students' college persistence questionnaire scores?

**H<sub>03.1</sub>:** There will be no effect on composite persistence scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A3.1</sub>:** There will be a significant effect on composite persistence scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>03.2</sub>:** There will be no effect on institutional commitment scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A3.2</sub>:** There will be a significant effect on institutional commitment scores for online EdD and EdS students enrolled in research and analysis courses after receiving a



seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>03.3</sub>:** There will be no effect on degree commitment scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A3.3</sub>:** There will be a significant effect on degree commitment scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>03.4</sub>:** There will be no effect on academic integration scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A3.4</sub>:** There will be a significant effect on academic integration scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>03.5</sub>:** There will be no effect on social integration scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A3.5</sub>:** There will be a significant effect on social integration scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>03.6</sub>:** There will be no effect on advising effectiveness scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A3.6</sub>:** There will be a significant effect on advising effectiveness scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>03.7</sub>:** There will be no effect on collegiate stress scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A3.7</sub>:** There will be a significant effect on collegiate stress scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>03.8</sub>:** There will be no effect on financial strain scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A3.8</sub>:** There will be a significant effect on financial strain scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>03.9</sub>:** There will be no effect on scholastic conscientiousness scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A3.9</sub>:** There will be a significant effect on scholastic conscientiousness scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>03.10</sub>:** There will be no effect on academic efficacy scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A3.10</sub>:** There will be a significant effect on academic efficacy scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>03.11</sub>:** There will be no effect on academic motivation scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional when compared to a control group.

**H<sub>A3.11</sub>:** There will be a significant effect on academic motivation scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

#### **Research Question Four and Hypotheses**

Will the online neuroeducational intervention have a significant effect on online EdD and EdS students' persistence in their research and analysis course?

**H<sub>04</sub>:** There will be no significant difference between the EdD and EdS students participating in the treatment group, who persist in their research and analysis course, when compared to a control group.

**H<sub>A4</sub>:** There will be a significant difference between the EdD and EdS students participating in the treatment group, who persist in their research and analysis course, when compared to a control group.

## **Participants**

The participants for this study were solicited from a pool of 354 EdS and EdS students registered for one of the four online, text-based asynchronous research and analysis courses delivered through the Internet via a Blackboard platform hosted at a private central Virginia university during the eight-week semester beginning January 14, 2013. To attract volunteer participants and to limit attrition, student participants were told that they would receive remuneration in the form of a \$15 Starbucks gift card, and would receive feedback on any survey participation. Descriptive statistics were run (a) to determine that any attrition did not impact the pertinent characteristics, i.e., age range, gender, and ethnicity, of the sample, and (b) to analyze the mean and standard deviation differences for materiality. Thirty students signed the informed consent form to participate in the study, which represented 8.5% of those taking research and analysis courses. Three students subsequently dropped their course leaving 27 students in the study, which represented 7.6% of those enrolled in research and analysis courses for the semester. After the treatment was administered, the means for the treatment group were higher in every measure other than autonomy orientation, which indicated that the intervention was having an effect, although not a significant effect.

### **Online Course: Advanced Educational Statistics (EDUC 712)**

This course involves an examination of descriptive statistics and basic inferential statistical techniques. During this research study, four professors taught this course to 159 students representing 44.9% of the 354 students enrolled in the four courses.

**Online Course: Quantitative Methods of Research (EDUC 715)**

This course is designed for those planning to write a dissertation. An examination of quantitative designs for educational research topics is included. Two professors taught this course to 77 students representing 21.8% of the 354 students enrolled in the four courses.

**Online Course: Advanced Research and Writing (EDUC 798)**

This course is designed to provide an overview of current educational research and its use as an inquiry tool. Students learn and apply professional writing skills by completing a final research project, and by writing and submitting an article for publication. Two professors taught this course to 58 students representing 16.4% of the 354 students enrolled in the four courses.

**Online Course: Qualitative Methods of Research (EDUC 817)**

This course examines qualitative methods used in educational research, focusing primarily on participant-observation, asking questions, writing field notes, and on the transformation of these primary field data into written ethnographic documents. Two professors taught this course to 60 students representing 16.9% of the 354 students enrolled in the four courses.

**Group Designation**

The participants in this study were divided into two groups (treatment and control) by using a random number generator provided through the website, [www.random.org](http://www.random.org). Prior to randomization, students were placed in stratas according to class and by degree level (EdS or EdD).

## Sample Size

For an experimental treatment to have internal validity (replicable), the sample size chosen should be based on statistical power, effect size, and significance level. The effect size was an important assumption for this study. A large effect size would indicate an expectation that the difference in the means being measured will be large, and therefore a smaller sample could be used in the data analysis; however, since this is a previously untested experiment, an effect size of .5 was chosen. Cohen's  $d$  relates this effect size as being a "medium" effect (Howell, 2011). Statistical power is important to protecting for Type 1 and Type 2 errors. For the purposes of this study, the statistical power of .80, a medium effect size of .5 using Cohen's  $d$ , and an alpha level (significance level) of .05 were used to compute the target sample size. Howell (2011) provided a formula for computing sample size:  $n = 2(\delta^2) / d^2$ . From the table (Howell, 2011, p. 595) delta (a value used in referring to power tables that combine  $d$  and the sample size), equals 2.80. With  $d$  equal to .5, then  $n = 63$ . In this research study, equal groups were assumed. Since there are two treatment groups, multiply  $n$  by two to arrive at a target sample size of 126. The target sample size for this study was increased by 26 students to 152 to allow for experiential mortality (Gall et al., 2007). For this research study, 30 students volunteered and signed the informed consent form, and 27 completed their coursework and the requirements for this research study. Based on this reduced sample size, the statistical power for this study was lower than anticipated. Field (2009) suggested that a researcher should have at least 10 to 15 participants per variable, and in a multivariate analysis of variance, there should be more cases than dependent variables.

Lenth (2007) suggested that once you get past 20 degrees of freedom PHP [post hoc power] does not even depend much on sample size for a given type of test. Since this study's sample size was 27, Lenth's note is important to remember when reviewing results.

### **Setting**

All of the students participating in this study were enrolled in research and analysis courses at a private central Virginia university (the site for this study). The university offers online and blended learning programs. The setting for this instructional intervention was in the online community of inquiry, and the intervention was offered completely online. The weekly lessons were asynchronous only, and were delivered through the Internet via a website hosted by web.com. Web.com's sitebuilder program consisted of an integrated set of tools for delivering course content, communicating with learners, and displaying multimedia files. Students accessed and retrieved content (videos, weblinks, self-reports, responses to blog posts). The electronic asynchronous communication supports used for course discussion and collaboration included email, announcements, and blog posts and comments to the blog posts.

### **Community of Inquiry for the Treatment Group**

Vallerand et al. (2008) suggested that future research should examine the feelings of competence, autonomy, and relatedness relating to a person's motivation. The purpose of this setting was to couple these three feelings with the components of the community of inquiry: teaching presence, social presence, and cognitive presence. Teaching presence is significant for the development and maintenance of a community of inquiry enabling the stages of practical inquiry: triggering event, exploration, integration, and resolution

(Garrison & Cleveland-Innes, 2005). Teaching presence within this setting was associated with weekly email communications offering encouragement and summaries of video lessons, self-reports, blog posts, and the design of the website. Social presence was fostered through the weekly interactive blog posts, the feedback from the VIEW instrument, and responses to student participant emails. The VIEW instrument feedback was given to enhance mindfulness about student preferences for orientation to change, manner of processing information, and ways of making decisions. Cognitive presence was fostered through the lessons, which provided education about how the brain responds to internal and external stimuli. Tips on the importance of physical activity, nutrition, positive thinking, emotions processing, and self-determination to brain optimization were provided to student participants in the treatment group.

### **The Intervention Website**

A 27 page website was constructed, which served as the intervention for the treatment group. Students could link to other websites from the treatment website, and access weekly lessons offered in multi-media, text, and graphical formats by accessing the website. The website included a weekly blog where the treatment group could post comments. The website was hosted by web.com on their servers. See Table 3.1 for the correlation of weekly assignments to the conceptual framework. The control group was provided with web-links to two end-of-course surveys: the CPQ and the GCOS.



Table 3.1

*Neuroeducational Intervention*

Conceptual Framework	Week of Treatment						
	1	2	3	4	5	6	7
Brain Optimization	x	x	x	x	x	x	x
Mindfulness	x	x	x	x		x	
Emotional Intelligence			x			x	x
Self Determination		x	x		x		

*Note.* “x” indicates that the item under conceptual framework was the featured lesson for the week.

See Exhibit E for details of each weekly lesson including the web addresses for videos used and summaries of the content.

The treatment group received two types of instrumentation.

- a) The 27 page website consisting of weekly video links, weekly tips for brain optimization, educational news, inspiration and humor, weekly self-report pages (see Appendix F), a creativity survey, a self-determination survey, a persistence survey, weekly blogs, and a welcome page was constructed for this intervention. The weekly instructional videos were selected from sources suggested by the graduate research librarian at the site. Students in the treatment group were given a link to the instructional website, which served as a portal for the neuroeducational lessons. Web-links to educational news, humor, inspiration, statistics help, and selected spiritual encouragement from YouTube sites were also availed through the website (see Appendix E for the home page screen shot and an outline of weekly modules). Treatment fidelity was monitored through receipt of a weekly self-report form that was generated from student access to the website. Treatment fidelity is the extent to which the conditions of the treatment,

as implemented, conform to the specifications of the treatment as prescribed by the researcher (Gall et al., 2007).

- b) A creative intelligence questionnaire, the "VIEW" instrument, was included as part of the intervention. This instrument was administered online, and the resulting scores were given to the treatment participants as feedback to alert them to their creative preferences and tendencies for dealing with change (OC), for processing information (MP), and for approaching tasks (WD). Isaksen (2012) reported that based on 31,360 cases, the Cronbach alphas for the VIEW instrument were:  $OC = .87$ ,  $MP = .86$ , and  $WD = .84$ .

The control group only participated in the posttest evaluation, which consisted of the GCOS and CPQ survey instruments.

### **Instrumentation**

The dependent variables consisted of end-of-course instructor-provided grades, two surveys with subscales, and a course persistence distribution. The validity of research measures were assessed by checking the inter-item correlation matrices for the scales, content reliability, criterion validity, and construct reliability. Cronbach's alphas were computed on each survey questionnaire to test for internal consistency. The following are the instruments utilized to measure the dependent variables:

#### **End-Of-Course Grades**

Student self-determination (competence, autonomy, and relatedness) is important to determining achievement-related outcomes (Brockelman, 2009; McLachlan & Hagger, 2010; Rovai, 2003); therefore, grades were a dependent variable in this study. Rovai (2003) cautioned the use of grades when they were not part of a system of measures;

which was not the case in this research study. These grades were provided by course instructors and taken from the instructor grade books at the end of the course. The grade scale is interval, and the following information was taken from the course syllabus for each course: A = 960–1010; A- = 940–959; B+ = 920–939; B = 890–919; B- = 870–889; C+ = 850–869; C = 820–849; C- = 800–819; D+ = 780–799; D = 750–779; D- = 730–749; and F = 729 and below.

### **Self-Determination Survey**

Self-determination was measured using the General Causality Orientations Scale (GCOS). The GCOS is a 36-item instrument that assessed three dimensions: intrinsic motivation ( $\alpha = 0.744$ ), extrinsic motivation ( $\alpha = 0.694$ ), and impersonal motivation ( $\alpha = 0.741$ ). The instrument was developed by Deci and Ryan (1985), and found to have construct validity in measuring these three dimensions. Answers were converted to 7-point scores, based on whether the response indicates something positive or negative about the student's motivation (-1 = very unlikely, 4 = moderately likely, +7 = very likely). See Appendix D for further information about the General Causality Orientations Scale. Permission to use the GCOS in this study was arranged through website permissions associated with downloading the instrument. Cronbach's alpha is the most common measure of reliability (internal consistency) for measuring the inter-correlation (unidimensionality) of test items, and is used to determine if the scale for a survey or questionnaire with Likert questions is reliable. SPSS reliability analysis was used to calculate Cronbach's alphas for this survey: Impersonal,  $\alpha = .82$ ; Controlled,  $\alpha = .50$ ; and Autonomy,  $\alpha = .70$ ).

## **College Persistence Questionnaire**

The college persistence questionnaire (CPQ) is a 69-item self-report survey that measures: academic integration ( $a = 0.81$ ), social integration ( $a = 0.82$ ), support services satisfaction ( $a = 0.74$ ), degree commitment ( $a = 0.70$ ), institutional commitment ( $a = 0.78$ ), and academic conscientiousness ( $a = .063$ ) (Davidson et al., 2009). See Appendix C to view the authorization to use the form in this research study, and to view the questionnaire. Participant answers on the questionnaire were converted to scores (see Appendix C for scoring rubric) based on whether the response indicates something positive or negative about the student's college experience (-2 = very unfavorable, -1 = somewhat unfavorable, 0 = neutral, +1 = somewhat favorable, +2 = very favorable). Some questions have reverse scoring and "not applicable" answers were not scored. Cronbach's alpha is the most common measure of reliability (internal consistency) for measuring the intercorrelation (unidimensionality) of test items, and is used to determine if the scale for a survey or questionnaire with Likert questions is reliable. SPSS reliability analysis was used to calculate Cronbach's alphas for this research study (see Table 3.1 for these coefficients).

Table 3.2

*Internal Consistency Estimates of Reliability for CPQ*

College Persistence Questionnaire Scale	
Dependent Variables	Cronbach Alpha
Academic Integration	.70
Financial Strain	.85
Social Integration	.70
Degree Commitment	.51
Collegiate Stress	.77
Advising	.61
Scholastic Conscientiousness	.73
Institutional Commitment	.36
Academic Motivation	.68
Academic Efficacy	.54
OVERALL	.88

**Chi-Square Distribution for Course Completion**

A chi-square test is a non-parametric test that can be used to analyze the differences between two independent proportions (Howell, 2011). The test was used to determine if the proportion of EdD and EdS students in the treatment group, who drop out of one of the research and analysis courses, is proportionate to the control group. There are two primary assumptions for chi-square analyses: independence of observations, and expected frequencies larger than five responses (Field, 2009).

**Procedures**

The timeline for this research study was during an eight-week semester period beginning January 14, 2013. Application for IRB approval was made after the dissertation committee formation, and after the research plan and proposal were approved. IRB approval number 1491.010713 was received on January 7, 2013 (see

Appendix A). Once IRB approval was given, the instructors assigned as faculty for the research and analysis courses were requested to forward an email attachment in the form of a word document announcing this neuroeducational study. The e-mail notified students of the study, and for those interested in participating, the email asked them to sign an informed consent and to self-report their demographics. Three follow up emails were sent due to the small number of respondents. Once the respondents had returned their informed consent form, they were stratified and then randomized into one of two groups: treatment or control.

A 27 page website was developed during the month prior to starting the research using web.com's site builder, and the web-link to this site was provided to the treatment group to view, download, and upload specific information. The website provided access to multimedia and text instruction about brain optimization and efficiency, self-determination, emotional intelligence, persistence, and also included web-links to relaxation and encouragement activities (see Appendix E). At the same time the website was being developed, the survey instruments were prepared for this intervention. The subjects in this study were notified that in exchange for their participation, they would receive a \$15 Starbucks gift card and feedback on completed surveys. In the final two weeks of the coursework, the intervention website directed the participants to complete two end-of-course surveys (CPQ and GCOS). An email with these survey links was also sent to the treatment and control groups. As a further incentive to continue with the treatment and to complete the surveys, students were informed that at completion they would receive an additional \$15 Starbucks gift card.

## Data Analysis

### Research Question One

The null hypothesis for research question one was tested using SPSS version 21. The end-of-course instructor provided grades were input into the data set. An independent-samples *t* test was performed to examine the first null hypothesis (see Chapter Four for results). The independent-samples *t* test determines if the observed difference between the sample means of the two groups is significant (Field, 2009). The reader should note that Campbell and Stanley (1963) suggested that this measure is not usually desirable as a posttest measure; however, others have found it to be beneficial (Brockelman, 2009; McLachlan & Hagger, 2010).

The independent-samples *t* test was used to examine the difference in the means of the grades between the treatment group and the control group. The alpha level was set at  $\alpha = .05$ , and the effect size interpreted using Cohen's (1988) conventions. The assumptions that were tested for the independent-samples *t* test included:

- The sampling distribution is normally distributed;
- The data will be measured at the interval level;
- Variances in the groups are roughly equal, i.e., homogeneity of variance; and
- Scores are independent. (Field, 2009).

Two additional assumptions for this research study are randomization of participants, and that there are no extreme outliers. Field (2009) suggested three ways of dealing with outliers: remove the case, transform the data, and change the score. This research study had two extreme outliers. After researching the cases, one outlier was removed from the study.

## Research Question Two and Three

The null hypotheses associated with research questions two and three was analyzed using SPSS version 21. The participant scores on the 13 subscales of the two dependent variables (GCOS and CPQ) were inputted into SPSS. The GCOS subscales were to be analyzed using a one-way MANOVA; however, the subscales were not significantly correlated in this data set. Thus, the GCOS subscales were analyzed using independent-samples  $t$  tests. The assumption testing listed above was completed. The null hypotheses for the CPQ were analyzed using a one-way MANOVA. There are four reasons for using a multivariate analysis of variance (MANOVA):

- a) The researcher is interested in the effects of treatments on several criterion variables individually;
- b) The researcher is interested in the relationships among the  $p$  variates (where  $p$  = number of criterion variates);
- c) The researcher wishes to reduce the  $p$  variates to some smaller set of psychological or theoretical dimensions; and/or
- d) The researcher is interested in the set of measures as they represent some underlying construct(s) or dimension(s). (Bray & Maxwell, 1982, p. 341)

A MANOVA is the appropriate test for examining two or more dependent variables that are correlated (Campbell & Stanley, 1963; Gall et al., 2007; Green & Salkind, 2011; Fraenkel & Wallen, 2006). Since the end-of-course College Persistence Questionnaire (CPQ) has multiple correlated subscales and each subscale is part of a system for a construct, a MANOVA is the appropriate choice (Gall et al., 2007). Where there were significant differences, i.e., a large  $F$  ratio and a  $p$  value less than the nominal



alpha, between the control and the treatment group on the linear combination of subscales for a measure, individual one-way ANOVAs were performed for each dependent variable. Each contrast was compared to nominal alpha divided by the number of contrasts. As the contrasts of interest are comparisons of two groups, there were several multivariate statistics available to perform an evaluation of the group differences, such as Pillai's Trace, Roy's Largest Root, and Hotelling's  $T^2$ , which were equivalent to the Wilk's lambda ratio (Bray & Maxwell, 1982). The Wilk's lambda  $F$  test is the best test for evaluations of two groups because the rank order of the canonical variate correlations is exactly equal to the rank order of the univariate  $F$  ratios (Bray & Maxwell, 1982). The actual ANOVA procedure was necessary for the subscale *Financial Strain*, as the between-group differences table in SPSS indicated a significance level of  $p < .05$ . A Bonferroni adjustment was made to control for Type 1 error. The data was evaluated using Version 21 of SPSS software. After assumption testing was completed and found tenable, the MANOVA test was performed, and the Wilk's lambda test was used in the MANOVA to assess significance ( $p < .05$ ). The effect size was calculated using the Eta squared statistic ( $\eta^2$ ) and interpreted using Cohen's  $d$  (1988).

There are nine primary assumptions underlying a one-way MANOVA. The MANOVA's primary assumptions are:

- Adequate sample size, i.e., the number of cases should exceed the number of subscales for each dependent variable (Field, 2009).
- Independence: Observations should be statistically independent (Green & Salkind, 2011).

- Random sampling: Data should be randomly sampled from the population of interest and measured at an interval level (Gall et al., 2007).
- Multivariate normality: The population variances and covariances among the dependent variables are the same across all levels of the factor. The two methods that were used to test this assumption were (a) to gather skewness and kurtosis data and convert them to *Z* scores to assess significance, and (b) the Kolmogorov-Smirnov test of significance (Field, 2009).
- There are no univariate or multivariate outliers. Outliers impacting a specific dependent variable or multiple dependent variables may impact the significance of the MANOVA test (Field, 2009). The Mahalanobis' Distance feature in SPSS will be used to test for multivariate outliers between centroids, and SPSS boxplots will be used to test for univariate outliers.
- Each dependent variable has a linear relationship within each group (Field, 2009). SPSS scatter/dot matrices were examined to determine if there was a line of best fit.
- Absence of multicollinearity and singularity (Field, 2009): this assumption was tested by performing a Pearson's *r* correlation. This statistic indicates the strength of the relationship between the treatment group and the control group for each of the subscales in the CPQ and GCOS analysis. In order to determine the unique contribution of each dependent variable, the variables should not be significantly correlated. The SPSS command Analyze-Correlate-Bivariate was used to analyze all of the subscales together. A strong correlation would be at or above  $r = .8$  (Field, 2009).

- Equality of variance-covariances (Field, 2009; Green & Salkind, 2011): The assumption is that the population variance-covariance matrices of the different groups in the analysis are equal. This assumption was examined using Box's *M* test to determine if the significance value is less than  $p < .05$ , which would mean that the assumption of equality of variance-covariances was violated (Field, 2009; Green & Salkind, 2011).
- Homogeneity of variance-covariance matrices (Field, 2009; Green & Salkind, 2011): The assumption of homogeneity of variances was examined using Levene's test at an alpha level of .05.

#### **Research Question Four**

Research question four will be analyzed using a chi-square 2 x 2 contingency table. Two assumptions are necessary for a chi-square analysis (Field, 2009):

- a) Independence of observations, i.e., each person contributes to only one cell of the contingency table.
- b) The expected frequencies should be greater than five to avoid a loss of power. If this assumption is violated, then Fisher's Exact test should be conducted (Field, 2009).

SPSS software was used to determine if the relationship was statistically significant. An alpha level of .05 will be used to determine significance. The following table provides the layout for the proportional analysis:

Outcome

	Course Drop	Course Persistence	Total
Treatment Group			
Control Group			
Total			

From the data collected from the course instructors, the above table was populated and the odds ratio was computed to explain the results (Field, 2009).

**Summary**

The purpose of this research study was to examine the effect of a neuroeducational intervention, which provided instruction on brain optimization, mindfulness, emotional intelligence, and self-determination on a volunteer convenience sample of EdD and EdS students enrolled in online research and analysis courses at a private central Virginia university to determine if the intervention would have a positive effect on the level of perseverance through the stages of practical inquiry when compared to a control group.

## **CHAPTER FOUR: RESULTS**

As highlighted in earlier chapters, the purpose of this research study was to examine the effect of a neuroeducational intervention, which provided instruction on brain optimization, mindfulness, emotional intelligence, and self-determination on a volunteer convenience sample of EdD and EdS students enrolled in online research and analysis courses at a private central Virginia university to determine if the intervention would have a positive effect on the level of perseverance through the stages of practical inquiry when compared to a control group. A posttest only, randomized control group research design was used to collect data and to evaluate the effect of this research study.

In this chapter, the data analysis of the results is presented. Each research question and related hypotheses is presented in the order stated in chapter three. The interpretation of these results will be presented in chapter five. An independent-samples *t* test was used to evaluate research question one to determine if the end-of-course grades were significantly different between the control group ( $n = 13$ ) and the treatment group ( $n = 14$ ). Separate one-way MANOVAs were conducted for research questions two and three to determine if the control group differed significantly from the treatment group on the multivariate centroids of three self-determination subscales and ten persistence subscales. A chi-square analysis was then conducted to compare each group's persistence in the research and analysis courses.

### **Descriptive Statistics**

Three hundred fifty four students were enrolled in one of four research and analysis courses offered during the eight-week semester beginning January 14, 2013. Thirty of these students (8.5%) volunteered to participate in this research study; however,

three students did not complete the study and were removed from the data analysis. This change lowered the participation rate to 7.6% of the sampling frame. The age, type of degree, and course demographics for these three students were not uniquely different from those that completed the study. Of the remaining volunteer participants, 37% were enrolled in Advanced Educational Statistics, 33% were enrolled in Quantitative Methods of Research, 23% were enrolled in Qualitative Methods of Research, and 7% were enrolled in Advanced Research and Writing. The sample consisted of 27 participants, 85% were female ( $n = 23$ ), while the rest were men ( $n = 4$ ). Student ethnicity for the participants consisted of 70% being Caucasian (note that this aligns with the broad study by CGS, 2010), 26% were African-American, and 4% were Asian. Approximately 7% of the participants were between the ages of 20 and 29, 37% were between the ages of 30 and 39, 33% between the ages of 40 and 49, 19% between the ages of 50 and 59, and 4% over the age of 59. EdS students represented 30% of the participants, and the remaining 70% were EdD students.

### **Research Question One and Related Hypotheses**

Will the online neuroeducational intervention have a significant effect on online EdD and EdS students' research and analysis end-of-course grades? An independent-samples  $t$  test was used to analyze end-of-course grades provided by instructors. This test is appropriate in situations in which there are two experimental conditions (treatment and control), and different participants make up each condition (Field, 2009). IBM's SPSS version 21 software was used for this analysis.

**H<sub>01</sub>:** There will be no effect on end-of-course instructor-provided grades for online EdD and EdS students enrolled in research and analysis courses after receiving a

seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A1</sub>:** There will be a significant effect on end-of-course instructor-provided grades for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

### **Descriptive Statistics**

The descriptive statistics for this analysis were different due to two grades not being received from a professor and due to the removal of an extreme outlier. As the reader will note, these revised descriptive statistics are comparable to the larger sample provided earlier in this chapter. See Table 4.1 for a comparison of group means and standard deviations. The reader should note that the treatment group mean for end-of-course grades was higher than the control group.

Table 4.1

*Descriptive Statistics for Independent-Samples t Test*

Dependent Variable	Treatment ( <i>n</i> = 12)		Control ( <i>n</i> = 12)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Grades	964.17	24.68	944.25	34.54

The volunteer participants for this sample had the following attributes: 38% were enrolled in Advanced Educational Statistics, 37% were enrolled in Quantitative Methods of Research, 17% were enrolled in Qualitative Methods of Research, and 8% were enrolled in Advanced Research and Writing. The sample consisted of 24 participants,

87% were female ( $n = 21$ ), while the rest were men ( $n = 3$ ). Approximately 71% of the participants were Caucasian, 25% were African-American, and 4% were Asian.

Approximately 8% of the participants were between the ages of 20 and 29, 33% were between the ages of 30 and 39, 38% between the ages of 40 and 49, 17% between the ages of 50 and 59, and 4% over the age of 59. EdS students represented 29% of the participants, and 71% were EdD students.

### **Assumption Testing for Research Question One**

The assumptions for this study were tested prior to running the independent-samples  $t$  test. The following is a listing of the assumptions and their results:

- a) Assumption one: the sampling distribution is normally distributed. This assumption was not tenable. Two tests were conducted to assess normality. The tests were accomplished using the SPSS Analyze-Descriptive Statistics-Explore command. The control group sample was normally distributed; however, the treatment group was not. The skewness was heavily to the right and the kurtosis was flat with a light tail (see Figure 4.1). This was additionally confirmed by computing the  $z$ -score for the treatment group, which was significant at  $\alpha = .05$  level. Any  $z$ -score above 1.96 would not represent a normal distribution, and the skewness was -2.88, while the kurtosis was 3.77. The Kolmogorov-Smirnov test did not indicate normality issues,  $p > .05$ ; however, the Shapiro-Wilk test was significant,  $p < .05$ . In order to achieve power of .8, a sample size of 72 is needed. As the sample for this study is 24, this test should be interpreted with caution.



Figure 4.1. Normality Distribution for the Treatment Group

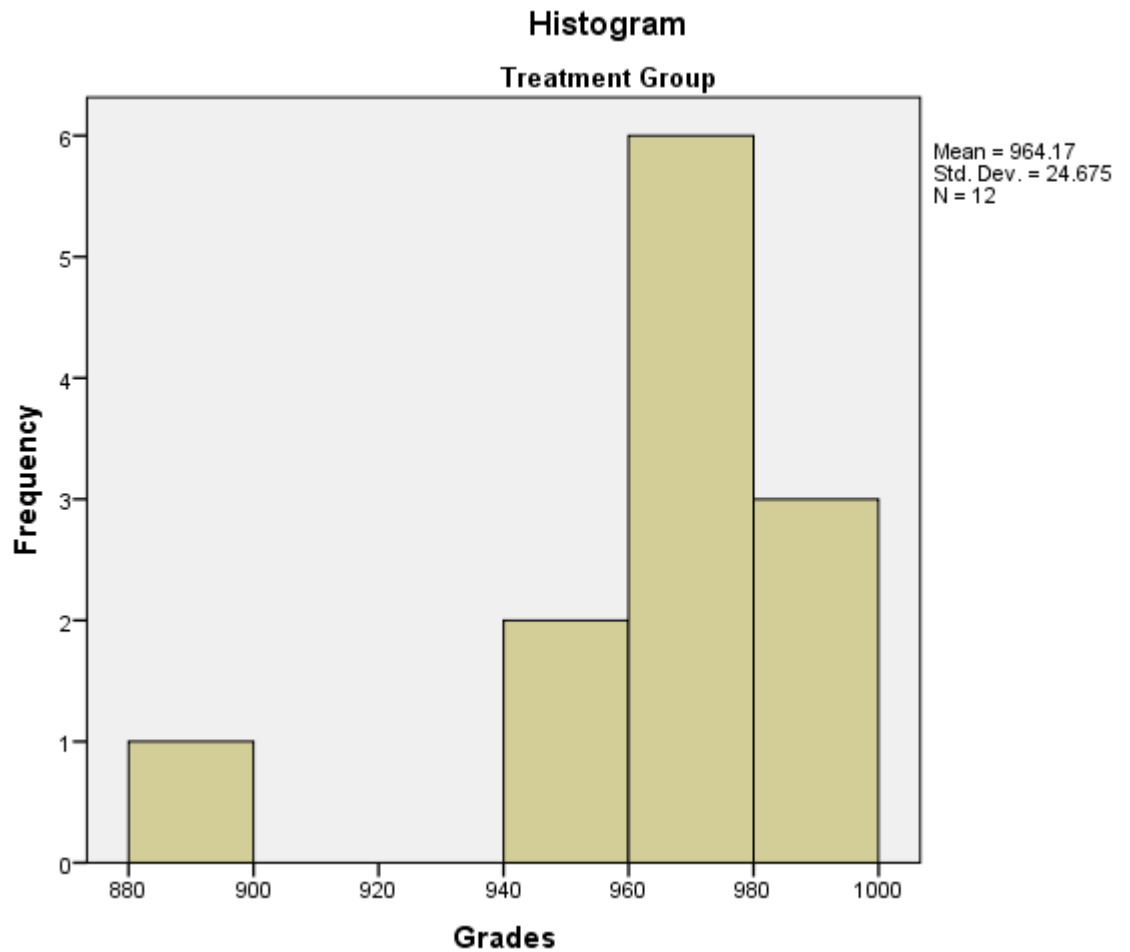


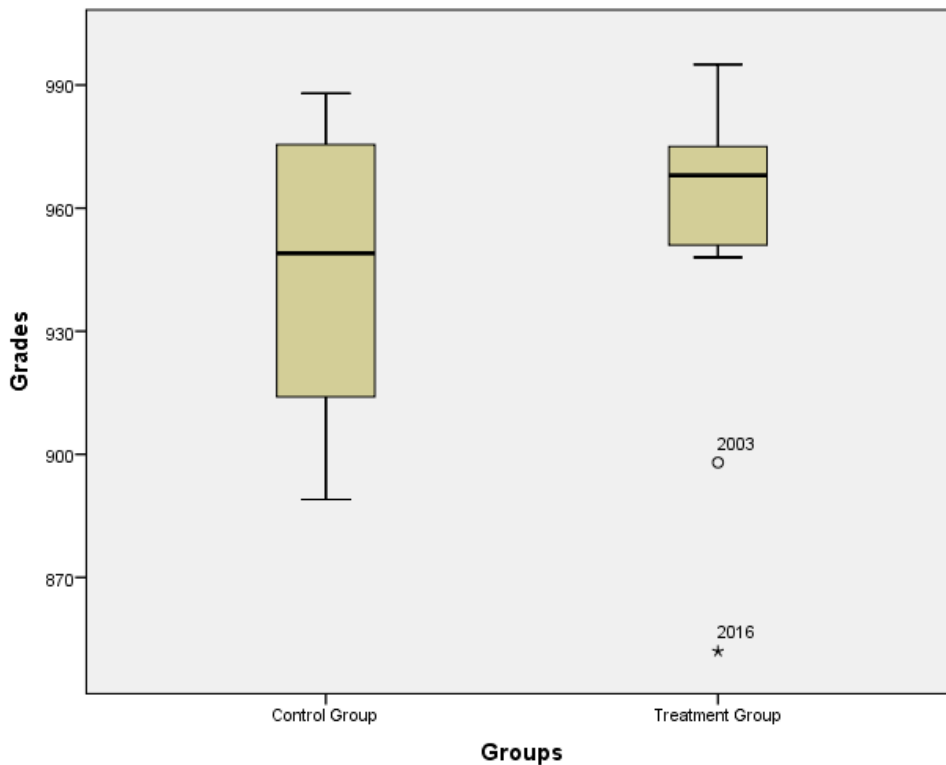
Figure Note. The treatment group's scores were heavily right skewed and flat.

- b) Assumption two: the data was measured at the interval level. The grades were scored on a 0 to 1,000 point scale.
- c) Assumption three: homogeneity of group variances was tenable. Levene's test was not statistically significant,  $p > .05$ .
- d) Assumption four: the scores were independent of each other. The participants were randomized into two groups (control and treatment) at the beginning of the

research study using the random sequence generator found at the website address: [www.random.org](http://www.random.org).

- e) Assumption five: there were no extreme outliers. There were two extreme outliers. Both were researched using the SPSS Analyze-Descriptive Statistics-Explore command. Boxplots labeled by case number revealed two scores in the treatment group that were outliers (see Figure 4.2). After researching the scores, the most extreme score (2016) was removed from this analysis. The participant with this score had rated extremely high on autonomy as determined by the GCOS instrument; therefore, it did not make sense that this score would be the lowest in the two groups. The participant's demographics were not uniquely different from those remaining in the test.

Figure 4.2. Boxplot Indicating Extreme Outliers



## **Results for Research Question Number One**

**H<sub>01</sub>.** An independent-samples *t* test was used to test the effects of the neuroeducational intervention on end-of-course grades, revealing a non-significant difference between conditions,  $t(22) = -1.625, p > .05; d = .66$ . On average, participants in the intervention experienced better grades ( $M = 964.17, SD = 14.52$ ) than the control group ( $M = 944.25, SD = 11.28$ ). This difference was not statistically significant; however, it did represent a medium-sized effect  $d = .66$ . Therefore, the null hypothesis is not rejected. The statistical power for this test was .37, which indicates that there is 37% chance that the correct decision was made about the null hypothesis. Thus, there is a six in ten chance of making a Type II error, and results should be applied with caution. To reduce the possibility of a Type II error to 20% or less, the sample size would need to be increased to 72, which is calculated based on using Cohen's *d* for this experiment.

### **Internal Reliability Test for the GCOS and CPQ**

Prior research (see Chapter Three) for these two instruments presented high scores for the subscales. The research question for this test was, "Should one or more subscales be deleted or revised to obtain better measures for the GCOS and CPQ?" Prior to running a one-way multivariate analysis (MANOVA) on the CPQ and GCOS, a test of the subscales for both instruments was performed to assess the internal consistency estimates of reliability. The lower the reliability, the closer the test becomes measurement error only (Field, 2009). To accomplish this estimate of reliability, data was entered into SPSS for each participant's score on the questions that made up the subscale. Using the SPSS command Analyze-Scale-Reliability Analysis, Cronbach's alpha reliability coefficients were computed on each subscale. Tests that yield alphas of .80 or higher are

reliable for research purposes (Gall et al., 2007). For scales with ten or less questions, an alpha above .2 would be acceptable (Briggs & Cheek, 1986).

The GCOS alphas were not reliable on two of the three subscales. An inter-item correlation test was conducted, which resulted in certain questions being removed from the Controlled subscale (questions 2, 4, 5, and 10) and the Autonomy subscale (questions 5, 6, and 9). The resulting Cronbach alphas were: Controlled subscale (consisting of eight questions),  $\alpha = .50$ ; Autonomy subscale (consisting of nine questions),  $\alpha = .70$ ; Impersonal subscale (consisting of twelve questions),  $\alpha = .82$ ; and overall,  $\alpha = .75$ . Although, these subscales were correlated in empirical research, the correlations were not statistically significant for this study; therefore, an independent-samples *t* test was conducted on each subscale rather than the MANOVA.

As all the subscales for the CPQ consisted of less than ten questions, they were deemed acceptable for this study. A multivariate analysis of variance combines the subscales to form a system; therefore, the alpha levels were determined using the overall CPQ. The alpha coefficient for the system of subscales was reliable,  $\alpha = .88$ . The CPQ subscales were mostly correlated, so a MANOVA test of the data was deemed appropriate. Table 4.2 provides a listing of the Cronbach alphas for each of the subscales within the CPQ and GCOS after the questions were removed.

Table 4.2

*Internal Consistency Estimates of Reliability for CPQ and GCOS*

CPQ		GCOS	
Dependent Variables	Cronbach Alpha	Dependent Variables	Cronbach Alpha
Academic Integration	.70	Impersonal	.82
Financial Strain	.85	Controlled	.50
Social Integration	.70	Autonomy	.70
Degree Commitment	.51	OVERALL	.75
Collegiate Stress	.77		
Advising	.61		
Scholastic Conscientiousness	.73		
Institutional Commitment	.36		
Academic Motivation	.68		
Academic Efficacy	.54		
OVERALL	.88		

**Research Question Two and Related Hypotheses**

Will the online neuroeducational intervention have a significant effect on online EdD and EdS students' self-determination scores? The researcher planned to use a one-way MANOVA to evaluate the effect of the neuroeducational intervention on self-determination scores as the GCOS instrument has three subscales: autonomy orientation, controlled orientation, and impersonal orientation; however, this assessment was not deemed appropriate as the three subscales were not found to be correlated in this data set (see Table 4.3). SPSS version 21 software was used to perform this analysis.

Table 4.3

*Correlations for General Causality Orientations Scale*

Dependent Variables		Impersonal	Controlled	Autonomy
Impersonal	Pearson Correlation	1	.31	-.25
	Sig. (2-tailed)		.12	.21
	Sample Size	27	27	27
Controlled	Pearson Correlation	.31	1	-.01
	Sig. (2-tailed)	.12		.95
	Sample Size	27	27	27
Autonomy	Pearson Correlation	-.25	-.01	1
	Sig. (2-tailed)	.21	.95	
	Sample Size	27	27	27

**H<sub>02.2</sub>:** There will be no effect on impersonal orientation for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A2.2</sub>:** There will be a significant effect on impersonal orientation for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>02.3</sub>:** There will be no effect on controlled orientation for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A2.3</sub>:** There will be a significant effect on controlled orientation for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>02.4</sub>:** There will be no effect on autonomy orientation for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A2.4</sub>:** There will be a significant effect on autonomy orientation for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

### **Descriptive Statistics for Research Question Two**

The descriptive statistics for this analysis were the same as given at the beginning of this chapter for the larger sample ( $n = 27$ ). The means and standard deviations for each subscale were reviewed for equality. See Table 4.4 for the group means and standard deviations. All students in this sample had higher mean scores on their autonomous orientation (self-regulation) than mean scores on their impersonal or controlled orientations. Rovai (2003, 2007) highlighted that this was an attribute for success in online courses.

Table 4.4

#### *Descriptive Statistics for General Causality Orientations Scale*

Dependent Variables	Treatment ( $n = 14$ )		Control ( $n = 13$ )	
	Mean	Standard Deviation	Mean	Standard Deviation
Impersonal	36.64	14.52	37.38	11.28
Controlled	30.93	5.93	34.54	6.05
Autonomy	55.38	5.88	54.36	6.51

## **Assumption Testing for Research Question Two**

The assumptions for this study were tested prior to running the independent-samples  $t$  tests. The following is a listing of the assumptions and their results:

- a) Assumption one: the sampling distribution is normally distributed. This assumption was tenable. Two tests were conducted to assess normality. The tests were accomplished using the SPSS Analyze-Descriptive Statistics-Explore command. The skewness and kurtosis indicated normal distributions for all three subscales. The Shapiro-Wilk test did not indicate normality issues,  $p > .05$ .
- b) Assumption two: the data was measured at the interval level. The scores were based on a 7-point Likert scale.
- c) Assumption three: homogeneity of group variance was tenable. Levene's test was not statistically significant for any of the three scales,  $p > .05$ .
- d) Assumption four: the scores were independent of each other. The participants were randomized into two groups (control and treatment) at the beginning of the research study using the random sequence generator found at the website address: [www.random.org](http://www.random.org).
- e) Assumption five: there were no extreme outliers. This assumption was tenable for the Impersonal and Controlled scales; however, the Autonomy scale had two outliers. Both of these outliers were researched and a decision was made to leave these cases in the study.

## **Results for Research Question Number Two**

**H<sub>02.1</sub>**. This hypothesis was not tested since a MANOVA was deemed inappropriate for this study.



**H<sub>02.2</sub>**. An independent-samples *t* test was used to test the effects of the neuroeducational intervention on impersonal orientations revealing a non-significant difference between groups,  $t(25) = .147, p > .05; d = .07$ . On average, participants in the intervention experienced a lower level of impersonal orientation ( $M = 36.64, SD = 14.52$ ) than the control group ( $M = 37.38, SD = 11.28$ ). This difference was not statistically significant; however, it did represent a minimal effect  $d = .07$ . Therefore, the null hypothesis is not rejected. The statistical power for this test was negligible. The power is low due to the small sample size. A power of .20 indicates that the researcher correctly failed to reject the null hypothesis with only 20% certainty. A Type II error is likely.

**H<sub>02.3</sub>**. An independent-samples *t* test was used to test the effects of the neuroeducational intervention on controlled orientations revealing a non-significant difference between groups,  $t(25) = 1.565, p > .05; d = .60$ . On average, participants in the intervention experienced a lower level of controlled orientation ( $M = 30.93, SD = 5.93$ ) than the control group ( $M = 34.54, SD = 6.05$ ). This difference was not statistically significant; however, it did represent a minimal effect  $d = .60$ . Therefore, the null hypothesis is not rejected. The statistical power for this test was .33. To reduce the possibility of a Type II error to 20% or less, the sample size would need to be increased to 86 participants, which is calculated based on using Cohen's *d* for this experiment.

**H<sub>02.4</sub>**. An independent-samples *t* test was used to test the effects of the neuroeducational intervention on autonomy orientation revealing a non-significant difference between groups,  $t(25) = .431, p > .05; d = .17$ . On average, participants in the intervention experienced a similar level of autonomy orientation ( $M = 54.36, SD = 5.88$ ) than the control group ( $M = 55.38, SD = 6.51$ ). This difference was not statistically

significant; however, it did represent a small effect  $d = .17$ . Therefore, the null hypothesis is not rejected. The statistical power for this test was negligible. The power is low due to the small sample size. A power of .20 indicates that the researcher correctly failed to reject the null hypothesis with only 20% certainty. A Type II error is likely.

### **Research Question Three and Related Hypotheses**

Will the online neuroeducational intervention have a significant effect on online EdD and EdS students' college persistence questionnaire scores? A one-way MANOVA was used to evaluate the effect of the neuroeducational intervention on persistence. The CPQ instrument has ten subscales: institutional commitment, degree commitment, academic integration, social integration, advising effectiveness, collegiate stress, financial strain, scholastic conscientiousness, academic efficacy, and academic motivation.

**H<sub>03.1</sub>:** There will be no effect on composite persistence scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A3.1</sub>:** There will be a significant effect on composite persistence scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>03.2</sub>:** There will be no effect on institutional commitment scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A3.2</sub>:** There will be a significant effect on institutional commitment scores for online EdD and EdS students enrolled in research and analysis courses after receiving a

seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>03.3</sub>:** There will be no effect on degree commitment scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A3.3</sub>:** There will be a significant effect on degree commitment scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>03.4</sub>:** There will be no effect on academic integration scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A3.4</sub>:** There will be a significant effect on academic integration scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>03.5</sub>:** There will be no effect on social integration scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A3.5</sub>:** There will be a significant effect on social integration scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>03.6</sub>:** There will be no effect on advising effectiveness scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A3.6</sub>:** There will be a significant effect on advising effectiveness scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>03.7</sub>:** There will be no effect on collegiate stress scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A3.7</sub>:** There will be a significant effect on collegiate stress scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>03.8</sub>:** There will be no effect on financial strain scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A3.8</sub>:** There will be a significant effect on financial strain scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>03.9</sub>:** There will be no effect on scholastic conscientiousness scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A3.9</sub>:** There will be a significant effect on scholastic conscientiousness scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>03.10</sub>**: There will be no effect on academic efficacy scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>A3.10</sub>**: There will be a significant effect on academic efficacy scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

**H<sub>03.11</sub>**: There will be no effect on academic motivation scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional when compared to a control group.

**H<sub>A3.11</sub>**: There will be a significant effect on academic motivation scores for online EdD and EdS students enrolled in research and analysis courses after receiving a seven-week online neuroeducational instructional module when compared to a control group.

### **Descriptive Statistics**

The descriptive statistics for this analysis were the same as given at the beginning of this chapter for the larger sample ( $n = 27$ ). The group means and standard deviations can be viewed in Table 4.5. The reader should note that the treatment group means were higher than the control group means for each of the ten measured subscales.

Table 4.5

*Descriptive Statistics for College Persistence Questionnaire*

Dependent Variables	Treatment ( <i>n</i> = 14)		Control ( <i>n</i> = 13)	
	Mean	Standard Deviation	Mean	Standard Deviation
Academic Integration	1.44	.47	1.20	.43
Financial Strain	.04	1.12	-1.24	.48
Social Integration	.56	.60	.32	.81
Degree Commitment	1.63	.46	1.36	.47
Collegiate Stress	-.30	.61	-.32	.87
Advising	1.32	.72	1.01	.59
Scholastic Conscientiousness	.91	.91	.55	1.08
Institutional Commitment	1.65	.54	1.48	.57
Academic Motivation	.96	.57	.66	.59
Academic Efficacy	1.36	.45	.96	.41

**Assumption Testing for Research Question Three**

The assumptions for this study were tested prior to running the one-way MANOVA. The following is a listing of the assumptions and their results:

- a) Assumption one: the scores were independent of each other. All scores for each question in the subscales were only used once for each participant.
- b) Assumption two: the sample size was adequate, i.e., there were more cases in each group than the dependent variables being analyzed (Field, 2009; Wilson VanVoorhis & Morgan, 2007). Although the sample size ( $n = 27$ ) was small (7.6% of the total students enrolled), this assumption was tenable, as there were 10 subscales.
- c) Assumption three: the dependent variables were multivariately normally distributed for each group. This assumption was tested in two ways. The first way

was to compute  $z$ -scores for the skewness and kurtosis of each dependent variable, and compare them to an absolute value greater than 1.96, which would be significant at  $p < .05$ . In this study, all subscales with the exception of four (Academic Integration, Degree Commitment, Scholastic Conscientiousness, and Institutional Commitment) were below this threshold (see Table 4.6). In a normal distribution, the skewness and kurtosis would be zero (Field, 2009). The second test for normality was the Kolmogorov-Smirnov test, which indicated a normality violation for the same subscales at  $\alpha < .05$ . A review of the boxplots revealed that there were several outliers that may have impacted normality. A decision was made to leave the outliers in the analysis due to the small sample size.

Table 4.6  
*Test for Multivariate Normality*

Surveys	Dependent Variables	Skewness	Kurtosis
CPQ			
	Academic Integration	-2.12*	0.64
	Financial Strain	1.57	0.64
	Social Integration	0.04	0.30
	Collegiate Stress	0.43	0.44
	Advising	0.99	0.06
	Scholastic Conscientiousness	2.19*	1.12
	Academic Motivation	0.77	0.70
	Degree Commitment	3.08*	1.59
	Institutional Commitment	2.82*	.66
	Academic Efficacy	.56	.31

\*Significant at absolute value 1.96 ( $p = .05$ )

- d) Assumption four: There is equality of variances and covariances. This assumption was tested using Box's test of equality of covariance matrices. There was some concern that the normality violations highlighted in Table 4.6 would impact this test; however, the test was non-significant, Box's  $M = 117.25$ ,  $F(55, 1992) = 1.18$ ,  $p = .17$ . This result could be due to the small sample size and a lack of power (Green & Salkind, 2011).
- e) Assumption five: the homogeneity of variance-covariances is tenable. This assumption was tested using Levene's test for homogeneity of variance-covariances, and found to be tenable for all subscales with the exception of financial strain, which was significant,  $p < .05$
- f) Assumption six: the participants come from a random sample. The participants were randomized into two groups (control and treatment) at the beginning of the research study using the random sequence generator found at the website address: [www.random.org](http://www.random.org).
- g) Assumption seven: there were no multivariate outliers. This assumption was tested univariately and multivariately. The SPSS command Graphs-Legacy Dialogs-Boxplots did find outliers associated with several subscales. Multivariate outliers were examined using the SPSS command Analyze-Regression-Linear to examine the Mahalanobis distance. No cases were found to be outside of the significance level,  $MD = .963$ ,  $p < .001$ .
- h) Assumption eight: each dependent variable has a linear relationship within each group. This assumption was analyzed using the SPSS command Graphs-Legacy



Dialog-Scatter/dot-Matrix Scatter and was found to be tenable. Cases appeared to be tightly associated.

- i) Assumption nine: there is an absence of multicollinearity and singularity.

Multicollinearity was tested using the SPSS Analyze-Regression-Linear command. The variance inflation factors for each subscale were less than ten (Field, 2009); therefore, this assumption was deemed tenable. The singularity assumption was tested by performing a Pearson's  $r$  correlation. This statistic indicates the strength of the relationship between the treatment group and the control group for each of the ten subscales in the CPQ analysis. In order to determine the unique contribution of each dependent variable, the variables should not be significantly correlated. The SPSS command Analyze-Correlate-Bivariate was used to analyze all of the subscales together. A strong correlation would be at or above  $r = .8$  (Field, 2009). All subscales ranged between  $r = -.04$  to  $r = .72$  making the singularity assumption tenable. See Table 4.7 for a listing of these correlations. Empirical research has found these subscales to be significantly correlated, and since most of the scales were significantly correlated as indicated in Table 4.7, a decision was made to treat the system of subscales as correlated.

Table 4.7

*Test for CPQ Subscales\**

Dependent Variables	Tests	AI	FS	SI	DC	CS	AD	SC	IC	AM	AE
Academic Integration (AI)	Pearson <i>r</i> Sig. (.01)	1.00	.11	.55**	.59**	-.13	.34	.55**	.22	.63**	.26
Financial Strain (FS)	Pearson <i>r</i> Sig. (.01)	.11	1.00	-.04	.28	.32	-.15	.31	.22	.09	.55**
Social Integration (SI)	Pearson <i>r</i> Sig. (.01)	.55**	-.04	1.00	.21	-.37	.29	-.02	-.15	.20	.06
Degree Commitment (DC)	Pearson <i>r</i> Sig. (.01)	.59**	.28	.21	1.00	.21	.26	.24	.72**	.31	.31
Collegiate Stress (CS)	Pearson <i>r</i> Sig. (.01)	-.13	.32	-.37	.21	1.00	.04	.13	.38	-.20	.52**
Advising (AD)	Pearson <i>r</i> Sig. (.01)	.34	-.15	.29	.26	.04	1.00	.09	.18	.17	.10
Scholastic											
Conscientiousness (SC)	Pearson <i>r</i> Sig. (.01)	.55**	.31	-.02	.24	.13	.09	1.00	.14	.62**	.37
Institutional Commitment (IC)	Pearson <i>r</i> Sig. (.01)	.22	.22	-.15	.72**	.38	.18	.14	1.00	.10	.32
Academic Motivation (AM)	Pearson <i>r</i> Sig. (.01)	.63**	.09	.20	.31	-.20	.17	.62**	.10	1.00	.34
Academic Efficacy (AE)	Pearson <i>r</i> Sig. (.01)	.26	.55**	.06	.31	.52**	.10	.37	.32	.34	1.00

\*. Sample size = 27.

\*\*. Correlation is significant at the 0.01 level (2-tailed).

### Results of Inferential Statistics for Research Question Three

**H<sub>03.1</sub>**. A one-way multivariate analysis of variance was conducted to determine the effect of the two experimental conditions (treatment and no treatment) on the CPQ, the dependent variable with ten subscales. The results of the MANOVA indicated there was not a statistically significant difference between the group receiving the neuroeducational intervention and the control group, who received no instruction; Wilk's

$\Lambda = .44$ ,  $F(1, 25) = 2.08$ ,  $p > .05$ ,  $\eta^2 = .57$ . Based on the non-significant results, the decision was made to fail to reject the null hypothesis. The observed power = .26, which indicates a 74% probability that a Type II error is possible.

**H<sub>03.2</sub>**. Since the one-way MANOVA was not statistically significant, a follow up one-way ANOVA was not conducted for Academic Integration; therefore, the null hypothesis was not rejected. A noteworthy finding from this hypothesis analysis was that the mean of the treatment group ( $M = 1.44$ ,  $SD = .47$ ) was higher than the control group ( $M = 1.20$ ,  $SD = .43$ ) indicating a stronger institutional commitment for the treatment group.

**H<sub>03.3</sub>**. Since the one-way MANOVA was not statistically significant, a follow up one-way ANOVA was not conducted; therefore, the null hypothesis was not rejected. A noteworthy finding from this hypothesis analysis was that the mean of the treatment group ( $M = 1.63$ ,  $SD = .46$ ) was higher than the control group ( $M = 1.36$ ,  $SD = .47$ ) indicating a stronger degree commitment for the treatment group.

**H<sub>03.4</sub>**. Since the one-way MANOVA was not statistically significant, a follow up one-way ANOVA was not conducted; therefore, the null hypothesis was not rejected. A noteworthy finding from this hypothesis analysis was that the mean of the treatment group ( $M = 1.44$ ,  $SD = .47$ ) was higher than the control group ( $M = 1.20$ ,  $SD = .43$ ) indicating a higher level of academic integration for the treatment group.

**H<sub>03.5</sub>**. Since the one-way MANOVA was not statistically significant, a follow up one-way ANOVA was not conducted; therefore, the null hypothesis was not rejected. A noteworthy finding from this hypothesis analysis was that the mean of the treatment

group ( $M = .56, SD = .60$ ) was higher than the control group ( $M = .32, SD = .81$ ) indicating a higher degree of social integration for the treatment group.

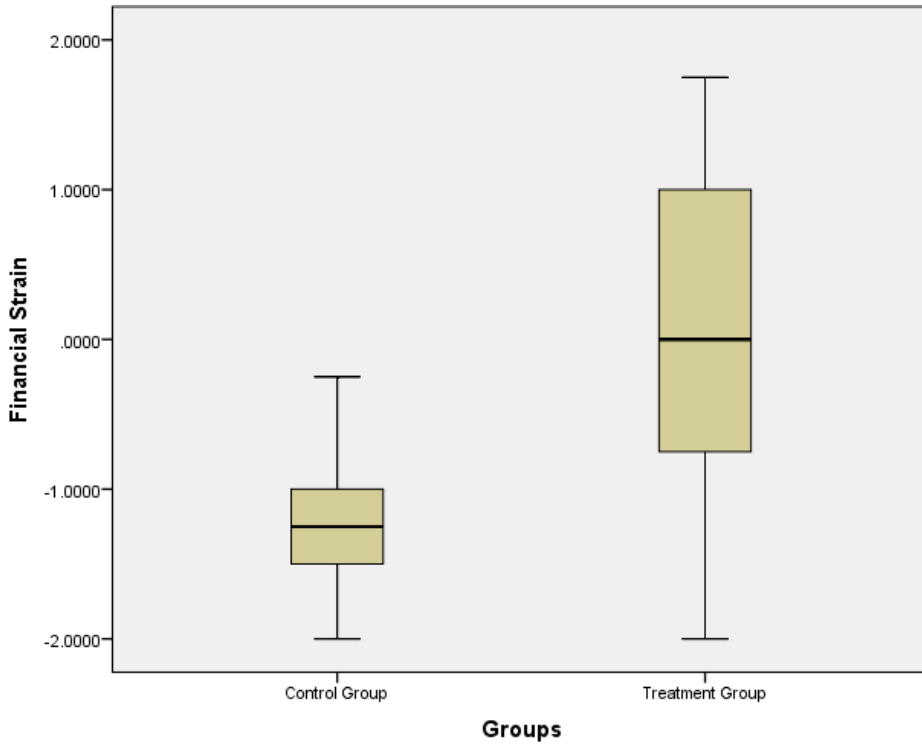
**H<sub>03.6</sub>.** Since the one-way MANOVA was not statistically significant, a follow up one-way ANOVA was not conducted; therefore, the null hypothesis was not rejected. A noteworthy finding from this hypothesis analysis was that the mean of the treatment group ( $M = 1.32, SD = .72$ ) was higher than the control group ( $M = 1.01, SD = .59$ ) indicating a higher level of satisfaction with advising for the treatment group.

**H<sub>03.7</sub>.** Since the one-way MANOVA was not statistically significant, a follow up one-way ANOVA was not conducted; therefore, the null hypothesis was not rejected. A noteworthy finding from this hypothesis analysis was that the mean of the treatment group ( $M = -.30, SD = .61$ ) was lower than the control group ( $M = -.32, SD = .87$ ) indicating a lesser degree of collegiate stress for the treatment group.

**H<sub>03.8</sub>.** Although the one-way MANOVA was not statistically significant, the Levene's test was statistically significant for this subscale,  $F(1, 25) = 11.69, p < .005$  (Bonferroni adjustment) . Based on the significance of Levene's test, an additional test of normality was conducted; however, the Shapiro-Wilk test results were not statistically significant,  $p > .05$ . An analysis of variance (ANOVA) on the subscale *Financial Strain* was conducted as a follow-up test to the MANOVA. Using the Bonferroni method, the ANOVA was tested at  $p < .005$  ( $p < .05/10$  subscales) level. The ANOVA on the Financial Strain scores was significant,  $F(1, 25) = 14.45, p = .001$ , partial  $\eta^2 = .37$ , observed power = .76. The reader should review Figure 4.3 for comparative detail. The treatment group ( $M = .04, SD = 1.12$ ) was significantly less concerned about the cost of

education than the control group ( $M = -1.24, SD = .48$ ) indicating a higher integration with their educational goal.

Figure 4.3. Boxplots for Financial Strain.



**H<sub>03.9</sub>**. Since the one-way MANOVA was not statistically significant, a follow up one-way ANOVA was not conducted; therefore, the null hypothesis was not rejected. A noteworthy finding from this hypothesis analysis was that the mean of the treatment group ( $M = .91, SD = .91$ ) was higher than the control group ( $M = .55, SD = 1.08$ ) indicating a higher level of scholastic conscientiousness.

**H<sub>03.10</sub>**. Since the one-way MANOVA was not statistically significant ( $p = .024$  after Bonferroni adjustment), a follow up one-way ANOVA was not conducted; therefore, the null hypothesis was not rejected. A noteworthy finding from this hypothesis

analysis was that the mean of the treatment group ( $M = 1.23, SD = .41$ ) was higher than the control group ( $M = .85, SD = .43$ ) indicating a higher level of academic efficacy.

**H<sub>03.11</sub>**. Since the one-way MANOVA was not statistically significant, a follow up one-way ANOVA was not conducted; therefore, the null hypothesis was not rejected. A noteworthy finding from this hypothesis analysis was that the mean of the treatment group ( $M = .96, SD = .57$ ) was higher than the control group ( $M = .66, SD = .59$ ) indicating a higher level of academic motivation.

#### **Research Question Four and Related Hypotheses**

Will the online neuroeducational intervention have a significant effect on online EdD and EdS students' persistence in their research and analysis course? A chi-square test was used to analyze the categorical data relating to persistence between the treatment group and the control group.

**H<sub>04</sub>**: There will be no significant difference between the EdD and EdS students participating in the treatment group, who persist in their research and analysis course, when compared to a control group.

**H<sub>A4</sub>**: There will be a significant difference between the EdD and EdS students participating in the treatment group, who persist in their research and analysis course, when compared to a control group.

#### **Descriptive Statistics for Research Question Four**

The descriptive statistics for this analysis were the same as given at the beginning of this chapter for the larger sample ( $n = 27$ ).

### Assumption Testing for Research Question Four

The assumptions for this study were tested prior to running the one-way MANOVA. The following is a listing of the assumptions and their results:

- a) Assumption one: observations were independent of each other, i.e., each person contributes to only one cell of the contingency table. This assumption was tenable.
- b) Assumption two: the expected frequencies should be greater than five to avoid a loss of power. This assumption was violated due to the small size of the sample. In situations where the sample size is small, it is appropriate to run the Fisher's exact test, which was computed in this study (Field, 2009).

### Results of Inferential Statistics for Research Question Four

**H<sub>04</sub>**. There was not a significant association between the type of treatment and course persistence as measured by a chi-square test,  $X^2(1) = .370, p > .05$ , as was also determined by Fisher's exact test,  $p > .05$ . Therefore, the null hypothesis is not rejected and the alternate hypothesis is rejected; however, the data suggests, based on the odds ratio, that the odds of persisting in research and analysis courses were 2.15 times greater with the neuroeducational intervention than without it. See Table 4.8 and Table 4.9 for the test results.

Table 4.8

*Chi-Square 2x2 Contingency Table*

Groups	Course Drop	Persist	Total
Treatment	1	13	14
Control	2	11	13
Total	3	24	27

*Note.* Output generated by SPSS version 21.

Table 4.9

*Chi-Square Tests*

Test Statistics	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.37 <sub>a</sub>	1	.54		
Continuity Correction <sub>b</sub>	.00	1	1.00		
Likelihood Ratio	.38	1	.54		
Fisher's Exact Test				1.00	.50
Linear-by-Linear Association	.36	1	.55		
N of Valid Cases	30				

*Note.* Output generated by SPSS version 21.

a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 1.50.

b. Computed only for a 2 x 2 table

### Summary

The results of the data analysis displayed no statistically significant differences between the experimental and control groups for this study. Based on the results, the research failed to reject the null hypotheses for each of the research questions.

An independent-samples *t* test was conducted on research question one, and did not result in a statistically significant difference between the treatment group and the control group for end-of-course grades; however, the treatment group had a higher mean score than the control group. Prior to conducting the independent-samples *t* test, each of the assumptions listed in Chapter Three was separately tested.

A one-way multivariate analysis of variance (MANOVA) was performed to examine group differences in EdD and EdS online students' self-determination. Prior to conducting the MANOVA, each of the assumptions listed in Chapter Three was separately tested. The results displayed no statistically significant difference between the experimental group and control group; however, the mean scores for the treatment group



were higher than the control group on the impersonal and controlled orientation subscales, and both the control and the treatment groups were high in autonomy orientations. Since the treatment group had a lesser level of autonomy orientation than the control group, the fact that the means for end-of-course grades and the subscales of the CPQ were higher for the treatment group may indicate that the neuroeducational intervention would have been significant given a larger sample size or longer time period for the study.

A one-way multivariate analysis of variance (MANOVA) was performed to examine group differences in EdD and EdS online students' persistence. Prior to conducting the MANOVA, each of the assumptions listed in Chapter Three was separately tested. The results displayed no statistically significant multivariate difference between the experimental group and control group; however, the mean scores for the treatment group were higher than the control group on every subscale. In addition, the subscale *Financial Strain* did have statistical significance, indicating that the treatment group was less concerned with the cost of their degree program than the control group. Considering that the treatment group means for degree commitment, academic integration, institutional commitment, scholastic conscientiousness, and academic motivation were also higher than the control group, the financial strain difference appears reasonable.

A chi-square 2 x 2 contingency table analysis was performed to determine if the control group or the treatment group had higher persistence levels. Prior to conducting the chi-square analysis, each of the assumptions listed in Chapter Three was separately tested. Since the sample size was small ( $n = 30$ ), Fisher's exact test was conducted.

Although the test was not statistically significant, the findings indicated that the treatment group was 2.15 times more likely to persist in their courses than the control group.

## CHAPTER FIVE: DISCUSSION

This research study examined four research questions: (1) Will the online neuroeducational intervention have a significant effect on online EdD and EdS students' research and analysis end-of-course grades? (2) Will the online neuroeducational intervention have a significant effect on online EdD and EdS students' self-determination scores? (3) Will the online neuroeducational intervention have a significant effect on online EdD and EdS students' college persistence questionnaire scores? (4) Will the online neuroeducational intervention have a significant effect on online EdD and EdS students' persistence in their research and analysis course?

This study's primary purpose was to determine if a neuroeducational intervention would positively influence perseverance through the stages of practical inquiry for online EdD and EdS students enrolled in research and analysis courses at a private central Virginia university. The second purpose of this quantitative study was to add to the empirical research on early interventions for online EdD and EdS students, which may have the further value of enhancing retention, and improving the educational experience for both the student and the institution.

Cognitive presence is associated with the successful facilitation and development of self-directed learning, metacognitive awareness, and reflective thinking, and is operationalized through the practical inquiry stages, i.e., triggering event, exploration, integration, and resolution (Garrison, 2003; Vaughan & Garrison, 2005). The conceptual framework for this study was modeled after the concept of cognitive presence, and postulated that perseverance through the stages of practical inquiry is inter-related with brain optimization, mindfulness, emotional intelligence, and self-determination. A

student who successfully completes his research and analysis course, receives a high end-of-course grade, obtains a high score for autonomy orientation, obtains high scores for academic integration, social integration, degree commitment, advisory satisfaction, scholastic conscientiousness, institutional commitment, academic motivation, and academic efficacy, and low scores for financial strain and collegiate stress will have demonstrated perseverance through the stages of the practical inquiry cycle.

Chapter One introduced the purpose of this study and the problem being addressed. It highlighted the learning theories that were foundational to the study. Chapter Two related the current state of practice to the learning theories, and presented the conceptual framework for this study. Chapter Three provided information on the methods used to conduct this study. Chapter Four presented the results. In this final chapter, the problem and purpose for the study will be restated, the research design and methodology will be reviewed, an interpretation of the results will be presented, the theoretical implications will be discussed, the limitations on the study will be highlighted, the practical implications for this study will be considered, and the implications for future research will be noted followed by a summary and conclusions.

### **Problem Statement**

The problem addressed by this study was the high attrition rate for online doctoral students (Rockinson-Szapkiw & Spaulding, 2012; Lovitts, 2005; Pauley et al., 1999; Smith et al., 2006; West et al., 2011), and the potential for using a neuroeducational intervention to positively affect perseverance. Due to the short-term nature of this intervention (seven weeks), perseverance was defined as completion of the practical inquiry cycle for online EdD and EdS students enrolled in research and analysis courses;

therefore, additional research will be required to explore the longitudinal impact on perseverance related to attrition rates.

The neuroeducational intervention designed for this study was a seven-week asynchronous teaching strategy that provided instruction on brain optimization, mindfulness, emotional intelligence, and self-determination, which are factors related to perseverance and cognitive presence (Duckworth et al., 2007; Rovai, 2007; Vaughan & Garrison, 2005) within the community of inquiry. The participants were a randomized convenience sample of EdD and EdS students enrolled in online research and analysis courses at a private central Virginia university. The setting was a website hosted by web.com that was availed to facilitate the online community of inquiry.

### **Review of Methodology**

Once the experimental design, intervention, and instruments were decided, Internal Review Board (IRB) approval was sought and obtained (see Appendix A). Instrument approvals for this study were requested and received (see Appendices C and D). Students were solicited by three emails—two were reminders—that were prepared by the researcher conducting this study. The solicitation emails were sent to students by their professors. To volunteer, students were required to electronically sign and return an informed consent form. After the students volunteered, they were randomized into two groups (treatment and no treatment), and the study was commenced. The treatment group was given the link to the intervention website (see Exhibit E). The welcome page for the website provided information and instructions on how to complete the weekly lessons. The control group informed consent was acknowledged and these participants were told that they would be asked to complete two surveys at the end of their coursework. Both

groups were told that they would receive a \$15 Starbucks gift card, and receive feedback on the surveys completed.

During the time period for gaining approvals, a 27 page website was constructed, which contained the content for the neuroeducational intervention. The graduate research librarian at the site suggested multimedia websites that contained content which could potentially be used for the lessons. After a rigorous selection process, eight videos relating to the conceptual framework were selected for this intervention (the weblinks to these videos are provided in Exhibit E). The intervention website was populated with the videos, brain facts, humor and inspiration, and relaxation links.

Prior to conducting any tests, internal reliability for the system of variates for the GCOS and CPQ was tested for content validity, criterion validity, and construct validity. An inter-item correlation matrix was reviewed for each subscale, and Cronbach's alphas were calculated for the subscale and for the overall system of variates for each survey instrument. This process resulted in certain questions being removed. An additional check for criterion validity was conducted to ensure that each question correlated with the subscale to which it was included. From this analysis, one subscale was found to have a question that was unrelated. The author of the instrument was contacted, and he confirmed that the question number needed to be changed. This change was made prior to conducting the research.

The parametric independent-samples *t* test, ANOVA test, MANOVA test, and non-parametric chi-square 2 x 2 contingency test are all methods of inferential statistical analysis designed to detect differences between and among groups (levels). Each of these

tests was used in this research study. In addition, descriptive statistics relating to each test were explored to ascertain that there was treatment group equality.

## Interpretation of Results

### Quantitative Analysis

An independent-samples *t* test was used to analyze question one. The results from this test were not statistically significant (see Table 5.1); therefore, the null hypothesis was not rejected.

Table 5.1

#### *Results for Research Question One*

Research Question and Null Hypothesis	Rejected	Failed to Reject	Sample Size
<b>RQ<sub>1</sub>:</b> Will the online neuroeducational intervention have a significant effect on online EdD and EdS students' research and analysis end-of-course grades? <b>H<sub>01</sub>:</b> There will be no effect on end-of-course instructor-provided grades when compared to a control group.		X	<i>n</i> = 24

*Note.* Although the results were not statistically significant, the mean scores of the treatment group were higher than the control group after the intervention.

The conceptual framework for this study was that perseverance was a construct that included brain optimization, mindfulness, emotional intelligence, and self-determination; therefore, this study viewed every test as part of a system of variates. Rovai (2003) posited that grades may not be a reliable barometer for learning, and that distance education program evaluations should be done together rather than evaluating individual components. The higher mean scores for the treatment group was the case for all 15 measures used in this study with the exception of the autonomy orientation measure. Even though none of the tests were statistically significant, this result is

noteworthy due to random assignment, which was a strategy used to control for extraneous variables. Howell (2011) reported that random assignment was important to ensure that the differences between the groups reflect only the differences in the treatments, and researchers should always aim for random assignment. Campbell and Stanley (1963) postulated that randomization “disrupts” any lawful relationships in the groups. Additional considerations should be given for the short time frame and small sample size for this study. There were only 24 participants (power = .37) in this test, which was less than the 72 participants needed to achieve power = .80. Campbell and Stanley (1963) reported that experimental evaluations of instructional methods using posttests at a single point in time should be viewed with caution, and further noted that long-range effects are greater for measuring psychological results. Cole, Maxwell, Arvey, and Salas (1994) posited that short time frames inhibit the reliability of the study. Akyol and Garrison (2011) reported that the short time period of a teaching method could inhibit resolution, which is the final stage in the practical inquiry cycle. Adult learning theory (andragogy) suggests that adults are self-directed and ready to learn (Knowles, 1977); however, research provides evidence that this is not always the case (Rabipour & Raz, 2012; Thayer & Broschot, 2005), and studies have found that the greatest changes occur through repeated practice over an extended period of time (Rabipour & Raz, 2012). The reader should view the results of this test together with the information above and the other results from this research study.

Three independent-samples *t* tests were used to analyze research question two (see Table 5.2).



Table 5.2

*Results for Research Question Two*

Research Question and Null Hypothesis	Failed to Reject	Sample Size
<b>RQ<sub>2</sub>:</b> Will the online neuroeducational intervention have a significant effect on online EdD and EdS students' self-determination scores?		
<b>H<sub>02.1</sub>:</b> There will be no effect on composite self-determination scores.	(2)	<i>n</i> = 27
<b>H<sub>02.2</sub>:</b> There will be no effect on impersonal orientation.	X	<i>n</i> = 27
<b>H<sub>02.3</sub>:</b> There will be no effect on controlled orientation.	X	<i>n</i> = 27
<b>H<sub>02.4</sub>:</b> There will be no effect on autonomy orientation.	X	<i>n</i> = 27

*Note.* (1) Although the results were not statistically significant, the mean scores of the treatment group were higher than the control group after the intervention for impersonal and controlled orientations.

(2) **H<sub>02.1</sub>:** This hypothesis was not tested, as an independent-samples *t* test was used rather than a one-way MANOVA.

Rovai (2003) posited that learner autonomy has been a “hallmark” of adult education, and an assumed characteristic of students enrolled in distance education; however, theory and research are not aligned in this regard. Self-efficacy theory and self-determination theory each highlight competence to be a key component (Bandura, 1977; Deci & Ryan, 1985). Research indicates that perceived competence in research and analysis courses is not prevalent in all students (Field, 2009), and that student motivation, emotional intelligence, and emotional self-efficacy may vary from student to student (Pool & Qualter, 2012; Rovai, 2007). This lack of perceived competencies may have prevented students from volunteering for this study, which could have impacted the results.

The impersonal orientation null hypothesis (**H<sub>02.2</sub>**) for research question two was not rejected. An impersonal orientation means that students correlate success with chance

and not with effort expended. After the neuroeducational intervention the treatment group had a lower impersonal orientation than the control group by approximately two percentage points. The controlled orientation null hypothesis ( $H_{02.3}$ ) was also not rejected. A controlled orientation indicates that students are less self-directed and are motivated by the actions of others or for external rewards. Again, after the intervention the treatment group had a lower controlled orientation than the control group by approximately 11.5%. The third hypothesis analyzed for research question two was the autonomy orientation null hypothesis ( $H_{02.4}$ ), which was not rejected. An autonomy orientation indicates that students are more self-directed and self-controlled. After the intervention the treatment group had a slightly lower autonomy orientation than the control group by approximately 1.8%. As mentioned above, this result could have been impacted by the volunteer bias of the participants. Rovai (2003) noted that self-directed learning in distance education programs recognizes the important initiating role of motivation and volition to perseverance. The GCOS scales were used in this study to examine if the neuroeducational intervention lessened impersonal and controlled orientations and improved autonomous orientations, which are important outcomes for success in online courses (Rovai, 2003). Although the results were not statistically significant for research question two, the mean scores for impersonal and controlled orientations were favorable for the treatment group. The participants in this test were randomly assigned. The reader should be aware of the potential for volunteer bias, the small sample size, and the short time frame associated with this intervention when reviewing the results for research question two.

A one-way MANOVA was used to analyze research question three.

Table 5.3

*Results for Research Question Three*

Research Question and Null Hypothesis	Rejected	Failed to Reject	Sample Size
<b>RQ<sub>3</sub>:</b> Will the online neuroeducational intervention have a significant effect on online EdD and EdS students' college persistence questionnaire scores?			
<b>H<sub>03.1</sub>:</b> There will be no effect on composite persistence scores.		X	<i>n</i> = 27
<b>H<sub>03.2</sub>:</b> There will be no effect on institutional commitment scores.		X	<i>n</i> = 27
<b>H<sub>03.3</sub>:</b> There will be no effect on degree commitment scores.		X	<i>n</i> = 27
<b>H<sub>03.4</sub>:</b> There will be no effect on academic integration scores.		X	<i>n</i> = 27
<b>H<sub>03.5</sub>:</b> There will be no effect on social integration scores.		X	<i>n</i> = 27
<b>H<sub>03.6</sub>:</b> There will be no effect on advising effectiveness scores.		X	<i>n</i> = 27
<b>H<sub>03.7</sub>:</b> There will be no effect on collegiate stress scores.		X	<i>n</i> = 27
<b>H<sub>03.8</sub>:</b> There will be no effect on financial strain scores.	X		<i>n</i> = 27
<b>H<sub>03.9</sub>:</b> There will be no effect on scholastic conscientiousness scores.		X	<i>n</i> = 27
<b>H<sub>03.10</sub>:</b> There will be no effect on academic efficacy scores.		X	<i>n</i> = 27
<b>H<sub>03.11</sub>:</b> There will be no effect on academic motivation scores.		X	<i>n</i> = 27

*Note.* Although the results were not statistically significant, the mean scores of the treatment group were higher than the control group after the intervention.

The results of the MANOVA indicated there was not a statistically significant difference between the group receiving the neuroeducational intervention and the control group, who received no instruction (see Table 5.3). Based on the non-significant results, the decision was made to fail to reject the null hypothesis. Levene's test and the tests between subjects highlighted two measures that were significant at the  $p < .05$  level: Financial Strain and Academic Efficacy; however, since there were 10 subscales in the

MANOVA, the Bonferroni adjustment ( $p < .005$ ) was the significance level for the evaluation. This removed Academic Efficacy from significance ( $p = .024$ ). Financial Strain relates to financial stress and payment difficulties, and a possible feeling of being disadvantaged in comparison to others. As Thayer and Brosschot (2005) reported in their study, items like financial stress can distract self-directedness. The neuroeducational intervention in this study elevated mindfulness as a strategy to mitigate distractions. The treatment group was significantly less concerned over finances than the control group indicating a higher integration with their educational aspirations. All of the other measures for this MANOVA had a treatment group mean gain over the control group; however, the results were not statistically significant at the  $p < .05$  level. Random assignment was again used to control for extraneous variables and to validate the treatment impact for this analysis.

The 30 volunteer participants for this study were approximately 8.5% of the 354 students which were enrolled in online research and analysis courses during the intervention period. Of the 30 students consenting for this study, three students dropped their course, leaving 27 students (7.6% of the population) in the study. This number represents only 18% of the target sample size anticipated, which lessened the statistical power associated with this study from a target .80 to .45. Gall et al. (2007) postulated that in experimental research there should be at least 15 participants in each group to be compared, which approximates the sample size of this study: treatment group ( $n = 14$ ) and control group ( $n = 13$ ).

As mentioned in Chapter Four, 82% of the volunteer participants were female, and 69% were under age 50. CGS (2010) reported similar demographics for the PhD

completion and attrition study. These demographics align with an article by Todd, Davis, and Cafferty (1984) that reported females and younger people were more likely to volunteer. The reader of this paper should not view this sample as heterogenetic.

**Qualitative Analysis**

A non-parametric chi-square test was used to analyze research question four. The null hypothesis was not rejected (see Table 5.4); however, the data suggests, based on the odds ratio, that the odds of persisting in research and analysis courses were 2.1 times greater with the neuroeducational intervention than without it.

Table 5.4

*Results for Research Question Four*

Research Question and Null Hypothesis	Failed to Reject	Sample Size
<p><b>RQ<sub>4</sub>:</b> Will the online neuroeducational intervention have a significant effect on online EdD and EdS students’ persistence in their research and analysis course?</p> <p><b>H<sub>04</sub>:</b> There will be no significant difference between the EdD and EdS students participating in the treatment group, who persist in their research and analysis course, when compared to a control group.</p>	X	<i>n</i> = 27

Rovai (2002) recommended using self-report measures to represent cognitive learning along with grades to increase understanding of research results; therefore, this study asked the treatment group students to submit weekly self-report forms. Akyol and Garrison (2011) concurred with Rovai (2002) suggesting that to obtain a holistic understanding of learning, researchers should examine both self-reports and grades. Self-reports heighten self-awareness (mindfulness) of progress through the stages of practical inquiry. An element of cognitive presence that takes place during the integration phase is

reflection (Garrison, 2001), and the intent of the self-reports was to enable this element to take place; however, these reports were not research and analysis course requirements, which may explain the significant reduction in self-reports during the last three weeks of the intervention. If students were not actively integrating the lessons from the intervention, the results for this study could have been negatively impacted.

The 83 self-reports received from the treatment group students indicated that the intervention website had been helpful (see Appendix F for an example of a self-report form). From a tally of the self-reports, 38% reported that the weekly video lessons were beneficial, 31% reported that the brain facts were beneficial, 26% reported that the inspiration and humor lessons were beneficial, and 6% reported that the educational news was beneficial. The comments made on the self-reports were positive. One student wrote, “This was a challenging week for me and the video clip with the eight success points helped a lot! Thanks. I’m glad I’m in this group.” Another student wrote, “Thanks for your work – it’s a little early for more comments but it was interesting and the reminder to stay positive is helpful since statistics is intimidating for me. Blessings to you!” One additional student wrote, “The advanced statistics course (EDUC 712) is challenging only because I have *perceived* [emphasis added] it as such. I no longer fear the course because I have sought the necessary online assistance needed to complete the assignments. My online research coupled with this study’s helpful hints have put this course into proper perspective – I can conquer it!”

All the student self-reports expressed a high degree of perceived learning in their courses. End-of-course grades aligned with this premise as indicated by only one student making below a “B.” Sixty-nine percent of the student responses indicated that the main

content on the conceptual framework for this study was useful. There were no negative comments provided on the weekly self-reports. The interpretation of these results is that the students achieved a higher level of cognitive presence in the community of inquiry.

### **Theoretical Implications**

The qualitative and quantitative results from this study should be viewed together to understand the overall impact of this study. In order for the learning theories presented in Chapter One to have external validity to online EdD and EdS students, the construct of perseverance should be considered. Research has demonstrated that brain optimization, mindfulness, emotional intelligence, and self-determination are important to goal-directed behavior. Neuroeducation integrates educational principles, psychology, biology, and cognitive science with deep learning strategies. Neuro-feedback (Rabipour & Raz, 2012) has been used to influence cognition, and is the educational process of allowing students to view how their brain waves respond to stimuli. The conceptual framework for this study is a new form of neuro-feedback. The successful facilitation of perseverance through the stages of practical inquiry is important to deep learning, and is strongly influenced by the instructional design, the community of inquiry, and the causal orientation of the student (Deci & Ryan, 1985; Garrison, 2003; Garrison & Cleveland-Innes, 2005; Rockinson-Szapkiw, 2011; Rovai, 2007). The community of inquiry should be designed to enable online EdD and EdS students to have the skills necessary to navigate stressors and distractions with confidence and courage (Smith et al., 2006; Martin, 2011). Duckworth et al. (2007) postulated the importance of developing passion for reaching long-term goals, which confirms the premise of integration to self-determined behavior (Deci et al., 1991). Igase et al. (2010) surmised that cognitive

impairment can be mitigated with strategies that enhance glucose metabolism in the brain, such as obtaining the proper nutrition and amount of physical exercise. Clauss-Ehlers (2008) highlighted the importance of adaptive coping and sociocultural support to resilience.

Research has demonstrated that a student's level of cognitive presence is also influenced by the online and blended learning environments (Akyol & Garrison, 2011) within the community of inquiry (Vaughan & Garrison, 2005). The research identified a gap in the literature (see Chapter Two) relative to the specific elements of an effective instructional design, and further suggested that quantitative studies were needed to explore interventions that facilitate perseverance through the practical inquiry stages, such as the neuroeducational intervention used in this research study.

The treatment website for this study was designed to enhance the community of inquiry in ways that facilitate perseverance through the stages of practical inquiry. The website provided specific neuroeducation on mindfulness, brain optimization, emotional intelligence, and self-determination, which align with the construct of cognitive presence through the stages of practical inquiry. The website complemented the community of inquiry construct (see Exhibit E). Social presence in the research and analysis courses was accomplished by offering empathy in the forms of encouragement, a weekly interactive blog, and suggested relaxation activities. Teaching presence was fostered by weekly lessons on elements of the perseverance construct, the use of weekly self-reports, weekly encouragement emails with summaries of the lesson content for each week, and feedback from the creativity survey. Cognitive presence was fostered through the content



of the seven weekly instructional modules, and the student self-reports, which caused the student to reflect on the course progress.

Chapter One presented information on learning theories associated with this research study: andragogy, self-efficacy, emotional intelligence, and self-determination theory. Andragogy (adult-learning theory) postulates that adults are self-directed, have an extensive depth of experience, are ready to learn, intrinsically motivated, and task centered (Knowles, 1977). Bandura (1977) discussed the importance of perceived competence to self-efficacy, and the importance of self-efficacy to perseverance. Emotional intelligence is defined as the unique individual responses to processing and managing emotions enabling successful functioning in everyday life (Bar-on et al., 2003; Freudenthaler, Neubauer, & Haller, 2008), and there are four dimensions of emotional mastery: self-awareness, self-management, social awareness, and relationship management (Goleman, 2011). Self-determination theory (SDT) presents an organismic metatheory that highlights tendencies to internalize the regulation of uninteresting though important activities in two qualitatively different methods—introjection and integration—depending on the social context (Deci et al., 1994). Introjection is a form of forced self-regulation where coping skills may be required to achieve the value of an activity. Integration—a central component of intrinsic motivation—is when the process of pursuing an activity or goal is assimilated with a person’s core sense of self.

Chapter Two explored current research related to these theories, and the conceptual framework for perseverance that was used in this research study was developed from these theories and research. Current research highlights that most adults do not represent the construct as generalized by the theory of andragogy. Unfortunately,

many adults have “learned” behaviors or lifestyles that alter this orientation. Actually, researchers have found that most adults are “externally” motivated and they often act impulsively, emotionally, or out of habit (Hechter and Kanazawa, 1997). Other research suggested that the amount of physical exercise and the type of nutrition impact brain optimization and peak performance (Dishman et al., 2006; Erikson et al., 2011; Fernstrom, 2005). Deficits in these two lifestyle factors can interfere with perseverance. Heuristics, such as taking a walk, avoiding poor nutritional choices, maintaining a positive attitude, creating to do lists, writing out goals, positive self-talk, avoiding distractions, and socialization, have been found to be effective (Dishman et al., 2006; van Gelderen, 2012).

As presented in Chapter Two, neuroeducation is a new instructional method that seeks to foster self-knowledge and training to regulate emotion and to enhance information processing speed, intrapersonal intelligence, and perseverance (Devonshire & Dommett, 2010; Goswami, 2006; Purdy & Morrison, 2009; Schrag, 2011; Willingham, 2009). For this research study, neuroeducation was implemented via an online website, which provided instruction on brain optimization, mindfulness, emotional intelligence, and self-determination.

The conceptual framework for perseverance was aligned to the instruments that were used to measure the results in this study. End-of-course grades, degree commitment, academic integration, academic efficacy, and institutional commitment aligned with brain optimization (Brockelman, 2009; Martin, 2011; McLachlan & Hagger, 2010; Sporns, 2011). Advising and scholastic conscientiousness aligned with mindfulness (Crews & Boettiger, 2009; Darowski et al., 2008; Ryback, 2006; Tang & Posner, 2009; Uncapher &

Rugg, 2009). Social integration, collegiate stress, and financial strain aligned with emotional intelligence (Bar-on et al., 2003; Gardner, 2006; Gliebe, 2012; Goleman, 2006; Luther et al., 2000a; Luther et al., 2000b; Mayer, Caruso, & Salovey, 2000; Terrell et al., 2009; Thayer & Brosschot, 2005). Academic motivation, impersonal orientation, controlled orientation, autonomy orientation, academic efficacy, academic integration, and end-of-course grades aligned with self-determination (Deci & Ryan, 1985; Deci et al., 1991; Garrison et al., 2001; Rovai, 2007; Vallerand, 2000; Vallerand et al., 2008).

This study adds to adult learning theory, self-efficacy theory, emotional intelligence theory, and self-determination theory. Each of the above theories ignored the inter-relationship of the current status of a student's brain optimization, mindfulness, emotion control, competence, autonomy, and relatedness to their construct. Perseverance is not just a long-range and goal-oriented outcome, it is also a process operationalized by cognitive presence, which results in successful navigation through the resolution stage of practical inquiry. Rovai (2003) highlighted that the current image of the adult learner may be wrong, which suggested that the five elements of andragogy— adults are self-directed, have an extensive depth of experience, are ready to learn, intrinsically motivated, and task centered—postulated by Knowles (1977) may be too broad focused. The author related that students may lack self-direction and self-discipline making them dependent learners and less likely to succeed in online courses. This can lead to student attrition and volunteer bias. Hermanowicz (2006) suggested that all students should be considered at risk for attrition, and Rovai (2003) suggested that to prevent students who are at risk for dropping out of their degree programs, new topics for interventions need to be identified.

This was the aim of this study; however, perceived insecurity may have prevented the “at risk” students from volunteering to participate in this study.

### **Limitations**

There were five limitations for this study. First, treatment fidelity was not assured. As this study was conducted by a peer doctoral student rather than a professor, the treatment group students may not have given this study a serious effort. Students in research and analysis courses are busy, and they may not have allocated the time to adequately study and integrate the web-based lessons. The completion of the intervention lessons by the treatment group students was measured by the receipt of a weekly self-report form. Eighty-three self-reports were generated by the treatment group. For week one through five, each student submitted a report; however, for weeks six and seven, only 64% were submitted; and in the final week, no self-reports were received. There were five main objectives for the self-report:

- a) To enable students to reflect on their course progress (cognitive presence), and to hold them accountable for taking each week’s lesson (treatment fidelity);
- b) To determine how students were doing in their coursework;
- c) To ascertain the level (based on a nine-point Likert scale) of assistance that the weekly lesson provided to students in their course perseverance;
- d) To ascertain which of the website’s features was most valued for the week toward helping students persevere in their coursework; and
- e) To allow for student comments and feedback.

To ensure that the lesson content from the weekly videos was communicated, the treatment group students were sent a summary of each weekly lesson’s content at the

beginning of the subsequent week in their coursework.

The second limitation was the sample size for the study. The target sample for the study was 152 online EdD and EdS students. After three solicitations, 30 students volunteered and 3 students dropped their courses and withdrew from the study. This smaller sample size may not be representative of the normal distribution, and lowered the statistical power assumption from .80 to .45.

The third limitation was that this research study was conducted with online EdD and EdS students enrolled in research and analysis courses during the Spring 2013 semester at a private central Virginia university; therefore, the external validity may not be generalizable to other doctoral students, institutions, and courses.

The fourth limitation was the short duration of the research. The results of this study may have been negatively influenced by the short time frame—seven weeks—of the study. There can be no assurance that students will change a lifestyle habit or a paradigm while they are taking an intensive course. Campbell and Stanley (1963) reported that experimental evaluations of instructional methods using posttests at a single point in time should be viewed with caution, and further noted that long-range effects are greater for measuring psychological results. Cole, Maxwell, Arvey, and Salas (1994) posited that short time frames inhibit the reliability of the study. Akyol and Garrison (2011) reported that the short time period of a teaching method could inhibit resolution, which is an important stage in the practical inquiry cycle.

The fifth limitation was that the sample was not heterogenic. The volunteers for this study were primarily younger Caucasian females, which aligns with research in the area of volunteerism. In addition, the students that volunteered may have only been the

self-assured students. The “at risk” students may have not been as self-determined as the students that volunteered.

### **Implications for Practice**

Chapter One presented details of the high rates of attrition for online doctoral students. This was the problem that this study addressed. The goal was to examine the effect of a neuroeducational intervention on perseverance through the stages of practical inquiry in research and analysis courses.

### **Implications for the Student**

Howell (2011) posited that a high percentage of students enroll in statistics only because it is a required course, and Field (2009) added that social science students generally despise statistics. Self-determination theory recognizes that introjection—a defense mechanism—is sometimes required to persevere through adversity. If students are made aware of the early need to formulate coping strategies in advance of adversity, their ability to prepare for adversity would be enhanced. A neuroeducational intervention and measurement at or before a resilient behavior is required in the online EdD and EdS student’s doctoral program could benefit those students who are weak in self-determination (perceived competence, self-regulation, and relatedness), i.e., lacking a completion mindset. Hermanowicz (2006) suggested that all students should be considered at risk for attrition.

The survey instruments used in this study and the lessons offered from the intervention website (see Exhibits C, D, E, and F) could benefit students with information that may enhance peak performance, intrapersonal intelligence, and emotional intelligence. The VIEW survey could help students with intrapersonal intelligence by

alerting them to their hard-wired preferences for dealing with change, making decisions, and manner of processing information. This information could be valuable in recognizing when coping skills are needed. The GCOS could help students with intrapersonal intelligence relating to their locus of causality orientation. Those students with high scores on impersonal or controlled orientations tend to be less self-regulated than those with a high autonomy regulation.

### **Implications for Higher Education**

The three survey instruments used in this study could be beneficial to higher education as a tool to identify at risk students or to enhance the “online” orientation process. Universities could include opportunities for students to increase their efficacy through knowledge, skills, and understanding relative to emotional functioning (Pool & Qualter, 2012). The CPQ survey could help faculty not only identify students at risk but provide them with multiple data points to use in advising students, and enable admissions in evaluating student factors that may negatively impact perseverance. Faculty may benefit from a better understanding of student stressors that could lead to attrition.

Tinto (2006) reported that attrition could be costly to students and institutions, and potentially damaging to institutional reputations. Kent, Julia D. (personal communication, April 5, 2013) polled her colleagues at the Council of Graduate Schools and found that the magnitude of the cost to institutions had not been quantified in their research; therefore, the cost of attrition is left up to speculation. Online higher educational institutions should attempt to quantify their attrition costs, which may further support the need for neuroeducation as an early orientation.

## Recommendations

The following is a list of recommendations that could assist institutions to reduce attrition and to enhance the academic relationship between the student and the institution of higher education.

- a) Instruct students on the community of inquiry: teaching presence, social presence, and cognitive presence.
- b) Explain to students how brain optimization, mindfulness, emotional intelligence, and self-determination interact with the stages of practical inquiry:
  - a. Triggering event: determine the issue, dilemma, challenge, and task ahead;
  - b. Exploration: grasp the nature of the problem or subject matter;
  - c. Integration: construct meaning from the exploration phase:
    - i. Use critical thinking and problem solving techniques,
  - d. Resolution: the point of transfer for meaning and understanding of the content; gain intuition and insight.
- c) Use neuroeducation on perseverance as an orientation for online EdD and EdS students:
  - a. Explain the conceptual framework for perseverance,
  - b. Provide instruction on each construct.
- d) Use the GCOS and CPQ instruments to identify and advise “at risk” online students:
  - a. Monitor online EdD and EdS students through the degree program.
- e) Identify the current cost associated with online attrition, and use this number as a benchmark to gauge progress over time.



## **Summary**

Neuroeducation is an emerging instructional strategy that has been shown to be effective for improving cognition, improving emotional intelligence and perceived competence, and for affecting changes in resilient behavior. In this study, treatment group perseverance appears to have been enhanced by the intervention; however, the quantitative results were not statistically significant. As Rovai (2003) mentioned, “There is no simple formula that ensures student persistence. Adult persistence in an online program is a complicated response to multiple issues” (p. 12). Neuroeducation is one strategy that online institutions should consider as an early orientation or as a complement to existing courses.

## **Implications for Future Research**

Future research is needed to examine the individual components of the perseverance construct (brain optimization, mindfulness, emotional intelligence, and self-determination), and their relationship to perseverance. Longer and more in-depth instruction on each component may enable students to construct meaning from the lessons, and to resolve internal conflicts that may inhibit lasting change.

The research community is not aligned on follow up procedures to a statistically significant MANOVA. Many studies, such as this study, view the multi-scale instruments as a system. Some researchers propose discriminant function analysis as a follow up technique to a significant MANOVA, while others use individual ANOVAs. Bray & Maxwell (1982) postulated that a MANOVA should be viewed as a system of variates test. Further research is needed to bring industry thinking into alignment.

The small sample size in this study (7.6% of those solicited,  $n = 27$ ) suggests that the low volunteer rate is due to volunteer bias. Todd et al. (1984) reported that younger individuals and females tend to volunteer, which was a result in this study. Additionally, Dollinger and Leong (1993) and McCrae and Costa (1987) suggested that the five-factor model of personality—comprising extraversion, agreeableness, conscientiousness, emotional stability versus neuroticism, and culture—could impact volunteer bias. Dependent (insecure) individuals are associated with disconnecting habits, such as blaming, complaining, punishing, threatening, criticizing, and rewarding in an attempt to control others (Hoogstad, 2008; Vallerand, Pelletier, & Koestner, 2008). These habits are “learned” behaviors and are representative actions from the limbic system of the brain where the perception of reality is assimilated (Amen, 2005; Blair, 2006). Dependent individuals lack self-efficacy and interdependence, and often have an impersonal motivational orientation (Deci & Ryan, 1985). The perceived level of dependency could influence a student to avoid volunteering or participating in any activity where control is not prevalent. Additional research may provide evidence as to how to attract and retain a heterogenous and representative sample at the target size to yield sufficient power from the population being studied.

Research that takes a longitudinal view or that examines individual factors in this study’s conceptual framework would be beneficial to better understanding the construct of perseverance. Neuroeducation could enable the construct of self-determination (perceived competence, autonomy, and relatedness) to be fostered within the online community of inquiry. To change a student’s paradigm about nutrition and exercise or to measure the benefits of increased physical activity levels and better nutrition could

require time periods in excess of seven weeks (the length of time for this study) to note measurable changes.

Future research might use the principles behind this study's conceptual framework in a comprehensive online orientation program. Early interventions could foster self-efficacy and relatedness to enable at risk EdD or EdS students to formulate a completion mindset (Bandura, 1977; Banks & Zions, 2010).

### **Summary and Conclusions**

Neuroeducation is a program or activity that seeks to enhance a cognitive skill or ability through a course of instruction over a designated time frame, and is the integration of educational principles, psychology, biology, and cognitive science. The problem addressed by this study was the high attrition rate for online doctoral students, and the potential for using a neuroeducation as an intervention to positively affect perseverance. Due to the short-term nature of this intervention (seven weeks), perseverance was defined as completion of the practical inquiry cycle for research and analysis courses; therefore, additional research will be required to explore the longitudinal impact on perseverance related to attrition rates. The conceptual framework was that student cognitive presence could be enhanced through a neuroeducational intervention. Cognitive presence was measured through a "system" of instruments.

Neuroeducation can inform individuals about how their brain processes emotions, and can provide the methods and strategies that lead to self-efficacy, brain optimization, resilience, and social and emotional intelligence (Amen, 2005; Beer & Bhanji, 2011; Caine & Caine, 1991; Clauss-Ehlers, 2008; Luthar, Cicchetti, & Becker, 2000a; Luthar, Cicchetti, & Becker, 2000b). Self-awareness, positive self-talk, self-monitoring, stress

mitigation strategies, and the process of writing down goals have been empirically proven to be effective in changing the impact of faulty emotions on decision making, especially in social situations (Akyol & Garrison, 2011; Amen, 2005; Beer & Bhanji, 2011).

Neuroeducational techniques like the ones mentioned above can be learned and applied to positively influence choices that lead to improved academic performance, self-determination, and persistence (Brockelman, 2009; Heatherton, 2011; Johnson, 2011; McLachlan, & Hagger, 2010), which was a goal of this study's neuroeducational intervention.

The results of this study were non-conclusive. The quantitative analysis did not yield statistically significant findings for all measures except Financial Strain. The null hypotheses were not rejected. Although the quantitative results were not statistically significant, the means of the treatment group were higher than the control group for all measures except for the autonomy orientation subscale, which is important for the reader to note due to random assignment. The qualitative information retrieved from self-reports indicated a positive effect. The design of this intervention took into account the perceived time pressure associated with research and analysis courses, and therefore included relaxation activities and inspiration to enable individuals to restore their global motivation should they have a loss in self-determined behavior (Vallerand, 2000).

This intervention, which integrated neuroeducation with learning theories (andragogy, self-determination, self-efficacy, and emotional intelligence), may have the further potential for enhancing online EdD and EdS retention rates through the creation of new and effective early interventions and early warning systems. Future research that expands the sample size for increased power, enhances heterogeneity, improves treatment

fidelity, and extends the time frame could be beneficial to demonstrating the value of neuroeducational interventions to reducing online EdD and EdS attrition.

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## APPENDIX A: IRB Approval

**LIBERTY**  
UNIVERSITY

The Graduate School at Liberty University

January 7, 2013  
Charles Cadle

IRB Approval 1491.010713: The Effect of Using a Pre-dissertation Intervention to Enhance Online EdD and EdS Student Academic Achievement, Self-Determination and Persistence

Dear Chuck,

We are pleased to inform you that your above study has been approved by the Liberty IRB. This approval is extended to you for one year. If data collection proceeds past one year, or if you make changes in the methodology as it pertains to human subjects, you must submit an appropriate update form to the IRB. The forms for these cases were attached to your approval email.

Thank you for your cooperation with the IRB and we wish you well with your research project.

Sincerely,

**Fernando Garzon, Psy.D.**  
*Professor, IRB Chair*  
**Counseling**

(434) 592-4054

## **APPENDIX B: AGE RANGES**

Baby Boomers – Born between 1946 and 1964

Generation Xers – Born between 1965 and 1982

New Boomers, Generation Y, or Millennials – Born between 1983 and 2001

**Source:** Population Reference Bureau (2009)

## APPENDIX C: COLLEGE PERSISTENCE QUESTIONNAIRE

Permission (Copy of Email)

CPQ Permission

Friday, October 26, 2012 5:12 PM Bill Davidson [bill.davidson@angelo.edu]

Actions

To:

Cadle, Charles R

Attachments:

[CPQ Student Experiences F~1.docx \(30 KB\)\[Open in Browser\]](#)

Thanks for your interest in the CPQ, Chuck. I am attaching the latest version and scoring instructions. It has 69 items, which cluster into 10 dimensions. Also, I am providing the URL to our website in case you develop an interest in collecting data via our automated systems. Your data can be easily downloaded into Excel or SPSS files. We are happy to assist in your endeavors.

Best wishes,

Bill

<https://www.beckdavidson.com/welcome/welcome.aspx>

Member, Texas Tech University System

**William B. Davidson, Ph.D.**

*Professor and Department Head*

*Department of Psychology, Sociology, and Social Work*

Angelo State University

ASU Station #10907

San Angelo, TX 76909-10907

Phone: (325) 486-6118 Fax: (325) 942-2290

[bill.davidson@angelo.edu](mailto:bill.davidson@angelo.edu)

### *College Persistence Questionnaire*

1. On average across all your courses, how interested are you in the things that are being said during class discussions?

very interested / somewhat interested / neutral / somewhat disinterested / very disinterested / not applicable

2. What is your overall impression of the other students here?

very favorable / somewhat favorable / neutral / somewhat unfavorable / very unfavorable / not applicable

3. How supportive is your family of your pursuit of a college degree, in terms of their encouragement and expectations?

very supportive / somewhat supportive / neutral / somewhat unsupportive / very unsupportive / not applicable

4. Students differ quite a lot in how distressed they get over various aspect of college life. Overall, how much stress would you say that you experience while attending this institution?

very much stress / much stress / some stress / a little stress / very little stress / not applicable

5. How easy is it to get answers to your questions about things related to your education here?

very easy / somewhat easy / neutral / somewhat hard / very hard / not applicable

6. In general, how enthused are you about doing academic tasks?

very enthusiastic / somewhat enthusiastic / neutral / somewhat unenthusiastic / very unenthusiastic / not applicable

7. College students have many academic responsibilities. How often do you forget those that you regard as important?

very often / somewhat often / sometimes / rarely / very rarely / not applicable

8. How confident are you that this is the right college or university for you?

very confident / somewhat confident / neutral / somewhat unconfident / very unconfident / not applicable

9. How often do you worry about having enough money to meet your needs?

very often / somewhat often / sometimes / rarely / very rarely / not applicable

10. How confident are you that you can get the grades you want?

very confident / somewhat confident / neutral / somewhat unconfident / very unconfident / not applicable

11. Some courses seem to take a lot more time than others. How much extra time are you willing to devote to your studies in those courses?

very much extra time / much extra time / some extra time / a little extra time / very little extra time / not applicable

12. In general, how satisfied are you with the quality of instruction you are receiving here?

very satisfied / somewhat satisfied / neutral / somewhat dissatisfied / very dissatisfied / not applicable

13. How much have your interactions with other students had an impact on your personal growth, attitudes, and values?

very much / much / some / little / very little / not applicable

14. How difficult is it for you or your family to be able to handle college costs? very difficult / somewhat difficult / neutral / somewhat easy / very easy / not applicable

15. How inclined are you to do most of your studying within 24 hours of a test rather than earlier?

very inclined / somewhat inclined / a little inclined / not very inclined / not at all inclined / not applicable

16. At this moment in time, how strong would you say your commitment is to earning a college degree, here or elsewhere?

very strong / somewhat strong / neutral / somewhat weak / very weak / not applicable

17. How much pressure do you feel when trying to meet deadlines for course assignments?

extreme pressure / much pressure / some pressure / a little pressure / hardly any pressure at all / not applicable

18. How satisfied are you with the academic advising you receive here?

very satisfied / somewhat satisfied / neutral / somewhat dissatisfied / very dissatisfied / not applicable

19. How well do you understand the thinking of your instructors when they lecture or ask students to answer questions in class?

very well / well / neutral / not well / not at all well / not applicable

20. How often do you turn in assignments past the due date?

very often / somewhat often / sometimes / rarely / very rarely / not applicable

21. How much thought have you given to stopping your education here (perhaps transferring to another college, going to work, or leaving for other reasons)?

a lot of thought / some thought / neutral / little thought / very little thought / not applicable

22. How often do you read educationally-related material not assigned in courses? very often / somewhat often / sometimes / rarely / very rarely / not applicable

23. How strong is your sense of connectedness with others (faculty, students, staff) on this campus?

very strong / somewhat strong / neutral / somewhat weak / very weak / not applicable

24. How good are you at correctly anticipating what will be on tests beforehand?

very good / somewhat good / neutral / somewhat bad / very bad / not applicable

25. When you think of the people who mean the most to you (friends and family), how disappointed do you think they would be if you quit school?

very disappointed / somewhat disappointed / neutral / not very disappointed / not at all disappointed / not applicable

26. How satisfied are you with the extent of your intellectual growth and interest in ideas since coming here?

very satisfied / somewhat satisfied / neutral / somewhat dissatisfied / very dissatisfied / not applicable

27. When considering the financial costs of being in college, how often do you feel unable to do things that other students here can afford to do?

very often / somewhat often / sometimes / rarely / very rarely / not applicable

28. When you think about your overall social life here (friends, college organizations, extracurricular activities, and so on), how satisfied are you with yours? very satisfied / somewhat satisfied / neutral / somewhat dissatisfied / very dissatisfied / not applicable

29. Students vary widely in their view of what constitutes a good course, including the notion that the best course is one that asks students to do very little. In your own view, how much work would be asked of students in a really good course?

very much / much / some / little / very little / not applicable

30. There are so many things that can interfere with students making progress toward a degree, feelings of uncertainty about finishing are likely to occur along the way. At this moment in time, how certain are you that you will earn a college degree?

very certain / somewhat certain / neutral / somewhat uncertain / very uncertain / not applicable

31. How often do you feel overwhelmed by the academic workload here?

very often / somewhat often / sometimes / rarely / very rarely / not applicable

32. How well does this institution communicate important information to students such as academic rules, degree requirements, individual course requirements, campus news and events, extracurricular activities, tuition costs, financial aid and scholarship opportunities?

very well / well / neutral / not well / not at all well / not applicable

33. How much of a connection do you see between what you are learning here and your future career possibilities?

very much / much / some / little / very little / not applicable

34. How often do you miss class for reasons other than illness or participation in school-related activities?



very often / somewhat often / sometimes / rarely / very rarely / not applicable

35. How much have your interactions with other students had an impact on your intellectual growth and interest in ideas?

very much / much / some / little / very little / not applicable

36. How often do you encounter course assignments that are actually enjoyable to do?

very often / somewhat often / sometimes / rarely / very rarely / not applicable

37. When you consider the techniques you use to study, how effective do you think your study skills are?

very effective / somewhat effective / neutral / somewhat ineffective / very ineffective / not applicable

38. After beginning college, students sometimes discover that a college degree is not quite as important to them as it once was. How strong is your intention to persist in your pursuit of the degree, here or elsewhere?

very strong / somewhat strong / neutral / somewhat weak / very weak / not applicable

39. How concerned about your intellectual growth are the faculty here?

very concerned / somewhat concerned / neutral / somewhat unconcerned / very unconcerned / not applicable

40. How much do you think you have in common with other students here?

very much / much / some / little / very little / not applicable

41. This semester, how much time do you spend studying each week relative to the number of credit hours you are taking? Assume each credit hour equals one hour of studying per week.

many more hours studying than the credit hours / a few more hours studying than the credit hours / the same number of hours studying as the credit hours / a few less hours studying than the credit hours / a lot less hours studying than the credit hours / not applicable

42. How much of a financial strain is it for you to purchase the essential resources you need for courses such as books and supplies?

very large strain / somewhat of a strain / neutral / a little strain / hardly any strain at all / not applicable

43. When you are waiting for a submitted assignment to be graded, how assured do you feel that the work you have done is acceptable?

very assured / somewhat assured / neutral / somewhat unassured / very unassured / not applicable

44. How much do other aspects of your life suffer because you are a college student?

very much / much / some / little / very little / not applicable

45. How often do you arrive late for classes, meetings, and other college events?  
very often / somewhat often / sometimes / rarely / very rarely / not applicable
46. How much time do you spend proofreading writing assignments before submitting them?  
a lot / some / little / very little / none / not applicable
47. How much doubt do you have about being able to make the grades you want?  
very much doubt / much doubt / some doubt / little doubt / very little doubt / not applicable
48. How would you rate the academic advisement you receive here?  
excellent / good / fair / poor / very poor / not applicable
49. How would you rate the quality of the instruction you are receiving here?  
excellent / good / fair / poor / very poor / not applicable
50. When you consider the benefits of having a college degree and the costs of earning it, how much would you say that the benefits outweigh the costs, if at all?  
benefits far outweigh the costs / benefits somewhat outweigh the costs / benefits and costs are equal / costs somewhat outweigh the benefits / costs far outweigh the benefits / not applicable
51. How likely is it that you will reenroll here next semester?  
very likely / somewhat likely / neutral / somewhat unlikely / very unlikely / not applicable
52. How likely is it you will earn a degree from here?  
very likely / somewhat likely / neutral / somewhat unlikely / very unlikely / not applicable
53. How much does the cost of courses limit how many you take?  
very much / much / some / little / very little / not applicable
54. When you think about the advantages and disadvantages of attending this school, how much do you think the advantages outweigh the disadvantages, or vice versa?  
disadvantages far outweigh the advantages / disadvantages somewhat outweigh the advantages / disadvantages and advantages are equal / advantages somewhat outweigh the disadvantages / advantages far outweigh the disadvantages / not applicable
55. During the first class session, many instructors present students with an overview of the course. In general, how accurate have these previews been in forecasting what you actually experienced in these courses?  
very accurate / somewhat accurate / neutral / somewhat inaccurate / very inaccurate / not applicable

56. How much do the instructors and the courses make you feel like you can do the work successfully?

very much / much / some / little / very little / not applicable

57. Based on your current financial situation, how inclined are you to work more hours per week than you want in order to pay bills?

very inclined / somewhat inclined / a little inclined / not very inclined / not at all inclined / not applicable

58. In general, when you receive evaluative feedback from instructors, how useful has it been in figuring out how to improve?

very useful / somewhat useful / neutral / not very useful / not at all useful / not applicable

59. On a typical day, how preoccupied are you with personal troubles?

very preoccupied / somewhat preoccupied / a little preoccupied / not very preoccupied / not at all preoccupied / not applicable

60. How fair are the tests at this school?

very unfair / somewhat unfair / neutral / somewhat fair / very fair / not applicable

61. The life of a college student typically has both positive and negative aspects. At this time, would you say that the positives outweigh the negatives, or vice versa?

positives far outweigh the negatives / positives somewhat outweigh the negatives / positives and negatives are equal / negatives somewhat outweigh the positives / negatives far outweigh the positives / not applicable

62. How clear have the instructors and syllabi usually been in detailing what you need to do in order to be successful in courses?

very unclear / somewhat unclear / neutral / somewhat clear / very clear / not applicable

63. On a typical day, how much do you worry about getting your work done on time?

very much / much / some / a little / very little / not applicable

64. Relative to what you expected when beginning college, how interesting have you found class sessions to be?

much less interesting / less interesting / about as interesting as expected / more interesting / much more interesting / not applicable

65. How much loyalty do you feel to this college, based on your experiences here?

very much loyalty / much loyalty / some loyalty / little loyalty / very little loyalty / not applicable

66. How often do you encounter course work that makes you wonder whether you can do it successfully?

very often / somewhat often / sometimes / rarely / very rarely / not applicable

67. If you are supposed to complete a reading assignment before the next class session, how likely are you to actually do it?

very likely / somewhat likely / neutral / somewhat unlikely / very unlikely / not applicable

68. How good is your school performance relative to the expectations of your parents or others who are important to you?

far below their expectations / below their expectations / about what they expected / better than they expected / much better than they expected / not applicable

69. How organized are you in terms of keeping track of upcoming assignments and tests?

very organized / somewhat organized / neutral / somewhat disorganized / very disorganized / not applicable

### **Scoring Instructions**

The Student Experiences Form of the *CPQ* employs a 5-point Likert-type scale. A sixth option, "Not Applicable," is included for students who feel that a particular item does not pertain to them. Verbal labels for the response scales depend on the wording of the question. For example, a question that asks "how satisfied" students are uses a response scale with "Very Satisfied" and "Very Dissatisfied" as end pegs. Another question that asks "how much" students like something is answered with end pegs of "Very Much" and "Very Little." Depending on the content of the question, answers are converted to 5-point "favorability" scores, based on whether the response indicates something positive or negative about the student's college experience (-2 = very unfavorable, -1 = somewhat unfavorable, 0 = neutral, +1 = somewhat favorable, +2 = very favorable). Score each question using the scales below.

*Regular Scoring Items:* 1, 2, 3, 5, 6, 8, 10, 11, 12, 13, 16, 18, 19, 22, 23, 24, 25, 26, 28, 29, 30, 32, 33, 35, 36, 37, 38, 39, 40, 41, 43, 46, 48, 49, 50, 51, 52, 55, 56, 58, 61, 65, 67, 69

*Score these items this way:*

Response 1 = +2

Response 2 = +1

Response 3 = 0

Response 4 = -1

Response 5 = -2

\* Do not score "Not Applicable" items

*Reverse Scoring Items:* 4, 7, 9, 14, 15, 17, 20, 21, 27, 31, 34, 42, 44, 45, 47, 53, 54, 57, 59, 60, 62, 63, 64, 66, 68

*Score these items this way:*

Response 1 = -2

Response 2 = -1

Response 3 = 0

Response 4 = +1  
Response 5 = +2  
\* Do not score “Not Applicable” items

**FACTORS:**

Academic Integration – 1, 12, 19, 26, 33, 39, 49

Academic Motivation – 6, 11, 15, 22, 29, 36, 41, 46

Academic Efficacy – 10, 24, 37, 43, 47

Financial Strain – 9, 14, 27, 42

Social Integration – 2, 13, 23, 28, 35, 40

Collegiate Stress – 4, 17, 31, 44

Advising – 5, 18, 32, 48

Degree Commitment – 3, 16, 25, 30, 38, 50

Institutional Commitment – 8, 21, 51, 52

Scholastic Conscientiousness – 7, 20, 34, 45

**CALCULATING FACTOR MEANS:**

1. Add up responses (from the +2 to -2 conversions) included in each factor
2. Add up total of Applicable Items (if student responded as Not Applicable, do not include this in the total).
3. Divide the Factor Total (Number from step 1) by the Applicable Items (Number from step 2).

**ITEMS THAT ARE NOT IN A FACTOR:**

A few of the items are not included in the factor scores. Either they are not statistically associated with any of the factors, or they are correlated with more than one factor, which makes them “complex” and ill-suited to be a measure of just one. However, they are included because the content is helpful to advisors.

## **APPENDIX D: GENERAL CAUSALITY ORIENTATIONS SCALE**

### **The General Causality Orientations Scale (GCOS)**

#### **Scale Description**

This scale assesses the strength of three different motivational orientations within an individual. These orientations, labeled Autonomy, Controlled, and Impersonal, are understood as relatively enduring aspects of personality, and each orientation is theorized to exist within each individual to some degree. There are three subscales to the measure, and a person gets a score on each subscale.

The Autonomy Orientation assesses the extent to which a person is oriented toward aspects of the environment that stimulate intrinsic motivation, are optimally challenging, and provide informational feedback. A person high in autonomy orientation tends to display greater self-initiation, seek activities that are interesting and challenging, and take greater responsibility for his or her own behavior.

The Controlled Orientation assesses the extent to which a person is oriented toward being controlled by rewards, deadlines, structures, ego-involvements, and the directives of others. A person high on the controlled orientation is likely to be dependent on rewards or other controls, and may be more attuned to what others demand than to what they want for themselves. In the U.S., at least, a person high in the controlled orientation is likely to place extreme importance on wealth, fame, and other extrinsic factors.

The Impersonal Orientation assesses the extent to which a person believes that attaining desired outcomes is beyond his or her control and that achievement is largely a matter of luck or fate. People high on this orientation are likely to be anxious and to feel very ineffective. They have no sense of being able to affect outcomes or cope with demands or changes. They tend to be amotivated and to want things to be as they always were.

The GCOS (Deci & Ryan, 1985a) is available in two forms. The original scale that is well validated and has been widely used consists of 12 vignettes and 36 items. Each vignette describes a typical social or achievement oriented situation (e.g., applying for a job or interacting with a friend) and is followed by three types of responses--an autonomous, a controlled, and an impersonal type. Respondents indicate, on 7-point Likert-type scales, the extent to which each response is typical for them. Higher scores indicate higher amounts of the particular orientation represented by the response. Thus, the scale has three subscales--the autonomy, the controlled, and the impersonal subscales--and subscale scores are generated by summing the individual's 12 responses on items corresponding to each subscale. A description of the 12-vignette version of the scale construction appears in Deci and Ryan (1985) along with data that support the instrument's reliability and validity. For example, the scale has been shown to be reliable, with Cronbach alphas of about 0.75 and a test-retest coefficient of 0.74 over two months, and to correlate as expected with a variety of theoretically related constructs.

Causality Orientations Theory presents a perspective on individuals' general motivational orientations that is complimentary to the more domain-specific approach of the Self-Regulation Questionnaires (e.g., Ryan & Connell, 1989) which considers reasons for engaging in a particular behavior such as doing one's school work. According to the more general GCOS perspective, it is possible to assess an individual's tendency to orient to and be guided by each of three general sources of behavioral regulation.

High *autonomy orientations* have, in past research, been associated with higher levels of self-esteem, ego development, and self-actualization (Deci & Ryan 1985) as well as greater integration in personality (Koestner, Bernieri, & Zuckerman, 1992). Cardiac-surgery patients high on the autonomy orientation were found to view their surgery more as a challenge and to have more positive post-operative attitudes, whereas those low on the autonomy orientation viewed their surgery more as a threat and had more negative post-operative attitudes (King, 1984). The *controlled orientation*, in contrast, has been related to the Type-A, coronary prone behavior pattern and to public self-consciousness (Deci & Ryan, 1985). Finally, the *impersonal orientation* has been found to predict higher levels of social anxiety, depression, and self-derogation (Deci & Ryan, 1985), and to discriminate restrictive anorectic patients from patients with other subtypes of eating disorders and from matched comparison subjects (Strauss & Ryan, 1987).

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## The Scale (12-vignette version)

These items pertain to a series of hypothetical sketches. Each sketch describes an incident and lists three ways of responding to it. Please read each sketch, imagine

yourself in that situation, and then consider each of the possible responses. Think of each response option in terms of how likely it is that you would respond that way. (We all respond in a variety of ways to situations, and probably most or all responses are at least slightly likely for you.) If it is very unlikely that you would respond the way described in a given response, you should circle answer 1 or 2. If it is moderately likely, you would select a number in the mid-range, and if it is very likely that you would respond as described, you would circle answer 6 or 7.

**The answer scale to be used with this vignette is as follows:**

1	2	3	4	5	6	7
very unlikely			moderately likely			very likely

1. You have been offered a new position in a company where you have worked for some time. The first question that is likely to come to mind is:
  - a) What if I can't live up to the new responsibility?
  - b) Will I make more at this position?
  - c) I wonder if the new work will be interesting.
2. You have a school-age daughter. On parents' night the teacher tells you that your daughter is doing poorly and doesn't seem involved in the work. You are likely to:
  - a) Talk it over with your daughter to understand further what the problem is.
  - b) Scold her and hope she does better.
  - c) Make sure she does the assignments, because she should be working harder.
3. You had a job interview several weeks ago. In the mail you received a form letter which states that the position has been filled. It is likely that you might think:
  - a) It's not what you know, but who you know.
  - b) I'm probably not good enough for the job.
  - c) Somehow they didn't see my qualifications as matching their needs.
4. You are a plant supervisor and have been charged with the task of allotting coffee breaks to three workers who cannot all break at once. You would likely handle this by:



- a) Telling the three workers the situation and having them work with you on the schedule.
  - b) Simply assigning times that each can break to avoid any problems.
  - c) Find out from someone in authority what to do or do what was done in the past.
5. A close (same-sex) friend of yours has been moody lately, and a couple of times has become very angry with you over "nothing." You might:
- a) Share your observations with him/her and try to find out what is going on for him/her.
  - b) Ignore it because there's not much you can do about it anyway.
  - c) Tell him/her that you're willing to spend time together if and only if he/she makes more effort to control him/herself.
6. You have just received the results of a test you took, and you discovered that you did very poorly. Your initial reaction is likely to be:
- a) "I can't do anything right," and feel sad.
  - b) "I wonder how it is I did so poorly," and feel disappointed.
  - c) "That stupid test doesn't show anything," and feel angry.
7. You have been invited to a large party where you know very few people. As you look forward to the evening, you would likely expect that:
- a) You'll try to fit in with whatever is happening in order to have a good time and not look bad.
  - b) You'll find some people with whom you can relate.
  - c) You'll probably feel somewhat isolated and unnoticed.
8. You are asked to plan a picnic for yourself and your fellow employees. Your style for approaching this project could most likely be characterized as:

- a) Take charge: that is, you would make most of the major decisions yourself.
  - b) Follow precedent: you're not really up to the task so you'd do it the way it's been done before.
  - c) Seek participation: get inputs from others who want to make them before you make the final plans.
9. Recently a position opened up at your place of work that could have meant a promotion for you. However, a person you work with was offered the job rather than you. In evaluating the situation, you're likely to think:
- a) You didn't really expect the job; you frequently get passed over.
  - b) The other person probably "did the right things" politically to get the job.
  - c) You would probably take a look at factors in your own performance that led you to be passed over.
10. You are embarking on a new career. The most important consideration is likely to be:
- a) Whether you can do the work without getting in over your head.
  - b) How interested you are in that kind of work.
  - c) Whether there are good possibilities for advancement.
11. A woman who works for you has generally done an adequate job. However, for the past two weeks her work has not been up to par and she appears to be less actively interested in her work. Your reaction is likely to be:
- a) Tell her that her work is below what is expected and that she should start working harder.
  - b) Ask her about the problem and let her know you are available to help work it out.
  - c) It's hard to know what to do to get her straightened out.

12. Your company has promoted you to a position in a city far from your present location. As you think about the move you would probably:
- a) Feel interested in the new challenge and a little nervous at the same time.
  - b) Feel excited about the higher status and salary that is involved.
  - c) Feel stressed and anxious about the upcoming changes.

Name or Code: \_\_\_\_\_

Sex: M      F (circle one)

Date: \_\_\_\_\_

**INDIVIDUAL STYLES QUESTIONNAIRE  
SCORING SHEET**

Deci & Ryan (1985) The General Causality Orientation Scale: Self Determination in Personality





















*Journal of Research in Personality, 19, 109-134*

*GCOS 12 item vignette*

Enter scores range 1- 7  
1 = Very unlikely to 7 = Very likely

Autonomy	0	A = Autonomy
Control	0	C = Control
Impersonal	0	I = Impersonal

Item	Score	Item	Score
1a    I		7a    C	
1b    C		7b    A	
1c    A		7c    I	
2a    A		8a    C	
2b    I		8b    I	
2c    C		8c    A	
3a    C		9a    I	
3b    I		9b    C	

3c	A		9c	A	
4a	A		10a	I	
4b	C		10b	A	
4c	I		10c	C	
5a	A		11a	C	
5b	I		11b	A	
5c	C		11c	I	
6a	I		12a	A	
6b	A		12b	C	
6c	C		12c	I	

R:\CLA\Appl\Wagman Lab\Test & assessments\Individual Assessments\Gen Caus Scale

### Studies that have used the GCOS

Deci, E. L., & Ryan, R. M. (1985). The general causality orientations scale: Self-determination in personality. *Journal of Research in Personality, 19*, 109-134.

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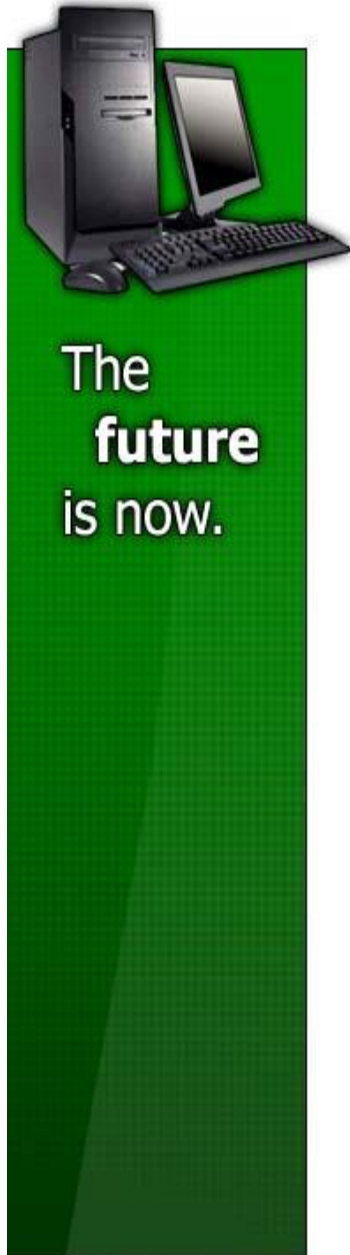
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## APPENDIX E: INTERVENTION

Note: This website address for this intervention was  
[www.cadlecrossing.com/thelibertyuniversityonlinechallenge](http://www.cadlecrossing.com/thelibertyuniversityonlinechallenge)



*The Liberty University On Line Challenge*

[START HERE](#) | [ABOUT ME](#) | [ASSIGNMENTS](#) | [HUMOR AND INSPIRATION](#) | [BREAK TIME](#) | [CURRENT EDUCATIONAL NEWS](#) | [BLOG POSTS](#) | [WEEK ONE](#) | [WEEK TWO](#) | [WEEK THREE](#) | [WEEK FOUR](#) | [WEEK FIVE](#) | [WEEK SIX](#) | [WEEK SEVEN](#) | [WEEK EIGHT](#)

**Welcome!**

*Research and analysis courses may put you outside your comfort zone. They can be frustrating, overwhelming, and can take your mind off your end goal. However, you can learn to enjoy these courses!*

*How do I know? Because I did.*

*I developed this website for you. I want to help you finish what you start. This is not a self-help site but rather a site to elevate your self-knowledge and self-awareness. The purpose of these weekly modules is to give you some tips and strategies to enhance your self-determination to persevere through statistics toward your end goal of receiving your EdD or EdS degree.*

*On these webpages you will find specific guidance to help you keep your focus. These will include:*

- *A creativity survey in week one to alert you to your "unique" problem-solving style (results provided in week 2)*
- *Some short challenges and games that can be done with friends and family*
- *Short video or audio clips about mind, brain, and education*
- *Tips on how the brain works and how nutrition, exercise, and emotions can help or hinder your progress*
- *News stories about current happenings in the field of education*
- *A "lighten up" section that pulls in Humor and Inspiration, and*
- *A weekly self-report to provide feedback on these modules and on your progress in your statistics course*

*You have made an investment of both time and money in pursuit of your EdS or EdD. This website is dedicated to helping you understand how your brain works and how important it is to stay optimistic, to see adversity as a fun challenge, and to stay mindful of your goals.*

*Let's get started, click on the ASSIGNMENTS tab to begin.*



## GUIDE TO WEEKLY VIDEO CONTENT

The following weblinks and notes are provided to summarize information relating to each week's video lesson.

WEEK ONE: <http://www.youtube.com/watch?v=d9ZjaKQsCjE>

1. Everything happens in the brain: words are read, objects are conceived, images are perceived, reality is formed, and limits are set by your imagination.
2. The brain weighs 3 pounds.
3. The brain contains 100,000 miles of blood vessels.
4. The brain contains 100,000,000 neurons vs. 1,000,000 silicon neurons in an advanced computer.
5. The brain has 1,000,000,000,000,000,000 (sextillion) synaptic connections.
6. Information is processed at 268 miles per hour.
7. The brain has 70,000 thoughts per day.
8. The brain never turns off and never stops learning.
9. The brain is the most complex organization of matter in the known universe.
10. The brain has no limits.

You have a brain. You have no limits.

Research: (Fridlander et al., 2011; Nussbaum, P. D. (2010). *Save your brain*. New York, NY: McGraw Hill.; and information taken from: <http://www.nursingassistantcentral.com/blog/2008/100-fascinating-facts-you-never-knew-about-the-human-brain/>)

WEEK TWO: <http://vimeo.com/48168437>

*Note:* watch this video to the 19:18 minute mark, the rest is optional.

### Perseverance

How to go deep with Jesus Christ. What qualities should we be working toward to be more like him? Guiding verse: 2 Peter 1:5-9

1. How you respond in crisis is driven by who you believe is in charge.
  - If you believe you are not in charge, you may seek to blame others, give excuses, or adopt bad habits.
  - If you believe God is in control, ask yourself: how big of a crisis is this really?

- Romans 8:28 (NIV) “And we know that in all things God works for the good of those who love him, who have been called according to his purpose.”
  - Temporary trials and pains work for our good because God loves us. God cares more about our character than about our comfort.
2. If you believe God is in control, consider trials an honor when they come. God trusts you to stand tall. He is going to be with you. You can do this. Do not despair. Hang onto your faith.
- James 1:2-4 (NIV) “Consider it pure joy, my brothers, whenever you face trials of many kinds, because you know that the testing of your faith develops perseverance. Perseverance must finish its work so that you may be mature and complete, not lacking in anything.”
  - God has entrusted you with an amazing assignment. You are “en pointe.” All senses are on high alert. Talking too much can be fatal. You should watch and listen. Constantly pray as you are walking. When under attack, focus on your leader. You will learn about faith and the power of obedience.
  - In the bible, deserts and large bodies of water are special to God’s heart. Searing deserts and raging storms at sea are where defining moments happen. These are God’s training grounds. If you are now in a searing desert or raging storm at sea, this might be your defining moment. Do not waste it.
  - God is never closer to you than when you are right in the middle of a defining moment. Purposely seek Him. He will not hide from you.
  - God uses deserts and seas to get us to surrender control. Perseverance is about surrender.
3. 1 Corinthians 10:13- God will never give us more temptation than we can handle. God is in the business of giving us more trials and pain than we can handle on our own.
- Rely only on God. Faith is the key to perseverance. With God, all things are possible; surrender, stop fighting.
4. Jesus sees you right now for what you will become. In the bible, an angel called Gideon a mighty warrior before the battle that he won.

- Jesus has a magnificent plan for you. Your mission is bigger than your current set of circumstances. Set your eyes outside of what you are going through.
  - People are always watching you. Is your faith real? Can they trust God?
5. You, like a boat, cut your biggest wake when you are in the hole. Focus outside your circumstances and God will bless you.
  6. Perseverance means to obey.
    - If you believe God is in charge, you surrender control, God has a plan for you, the mission is larger than your circumstances; do whatever God says.

WEEK THREE: [http://www.ted.com/talks/richard\\_st\\_john\\_s\\_8\\_secrets\\_of\\_success.html](http://www.ted.com/talks/richard_st_john_s_8_secrets_of_success.html)

#### Eight Secrets to Success

1. Passion: Do it for love, not for money.
2. Work: Always work hard. Nothing comes easily. Have fun.
3. Get good at what you are working at - practice.
4. Focus yourself to one thing.
5. Push yourself physically and mentally. Push through self-doubts about not being good enough and shyness.
6. Serve: It is a privilege to serve. Even millionaires serve others by providing something of value.
7. Ideas: Listen, observe, be curious, ask questions, problem solve and make connections. Founding the first micro-PC software company was an excellent idea.
8. Persist through a failure. Persist through CRAP: Criticism; Rejection; Assholes; and Pressure.

WEEK FOUR:

<http://www.bing.com/videos/search?q=Brain+Health+Tips&view=detail&mid=5A211C3FFAD820F931805A211C3FFAD820F93180&first=0>

#### How Nutrition Impacts the Brain

Choose foods high in antioxidants to help protect the brain and to help keep memory sharp. Eat good fats on a regular basis to keep your brain as healthy as possible. Supplement with Omega 3 fatty acids. They are essential for feeding the brain and for whole body optimal health.

The following are four foods that are particularly good for your brain:

1. Blueberries are the highest in antioxidants. Antioxidants protect from free radical damage. The phytochemicals in blueberries slow memory decline.
2. Avocados are high in monounsaturated fats which are good for your brain. They are also high in fiber and Vitamin E.
3. Hummus is brain boosting. It provides high energy, complex carbohydrates, protein and healthy fats.
4. Almonds are a brain food. They are high in good fat, protein, and minerals like magnesium and calcium. About 20 almonds is an ounce, which is perfect size for a snack to keep blood sugar level between meals and to feed your brain.

Research: (Carlson et al., 2007; D’Anci et al., 2008; Fernstrom & Fernstrom, 2007; Gailliot, 2008; Gomez-Pinella, 2008; Markus et al., 2005; Markus et al., 2002; Tully & Bolshakov, 2010; Turner, 2011; Wurtman et al., 2003)

WEEK FIVE: <http://www.bing.com/videos/search?q=self-determination&view=detail&mid=9E128E446835F921737F9E128E446835F921737F&first=181>

### Self Determination Theory

Self-determination theory is the theory of self-motivation. People are not always motivated by rewards. Intrinsic motivation is more powerful to encourage a person to act in certain ways.

### Motivational Spectrum

-----Extrinsic Spectrum-----

Amotivation	External Regulation	Introjection	Identification	Integration	Intrinsic
(None)	You do not want to, you are told to.	Status: may not want to but others may value you.	Make external motivator your own. You can see some value in it, but don't really want to do it.	Complete alignment with your goals but you don't love it.	Love it. Nothing external is required to get you to do it.

What does it take to make something intrinsically motivating? The following are three characteristics of intrinsic motivation:

1. Competence-A person’s sense of ability, accomplishment; makes you feel good about yourself
2. Autonomy-A person feels they are in control and can make meaningful choices about the path to take
3. Relatedness-The activity is connected to something beyond yourself that could be some sense of meaning or purpose. Social interaction is an element of relatedness.

Research: (Lovitts, 2005; Patrick, Hisley, & Kempner, 2000; Pauley et al., 1999; Palmer et al., 2001; Rovai, 2003; Rovai, 2002; Ryan & Deci, 2000; Ryan & Deci, 2008; Ryan & Deci, 2006; Sheldon et al., 1996; Solanski & Lane, 2010; Spence et al., 2003)

WEEK SIX: <http://www.vxv.com/video/fBbvPhEwNCjV/25-top-memory-improvement-brain-health-tips.html>

## 25 Tips for Memory Improvement

1. Caffeine: Temporarily boosts memory and shortens reaction time. Coffee and tea also provide antioxidants.
2. Visualizing: Creating detailed imagery and associations can help solidify memories long-term.
3. Napping 10-20 minute naps can help consolidate memories and learning. Longer naps will make you groggy.
4. Memory jogs: Write reminders and strategically place where they are visible.
5. Brain training: Through brain training, it is possible to improve working memory along with other cognitive abilities.
6. Enrich your environment: Through engaging people, media and new experiences, you can improve learning, cognitive reserve and reinvigorate faded memories.
7. Get enough sleep: Sleep consolidates learning and the formation of new memories from the day's experiences. 7-9 hours are required for most people.
8. Breathing: Deep slow breathing can de-activate the "flight or fight" side of the nervous system, protecting the brain from the damaging memory effects of excessive stress.
9. Hydration: Proper hydration boosts the speed of neuronal firing. Alcohol, caffeine, sugar and high protein foods are dehydrating. Eight 8 oz. glasses of water are ideal.
10. Sugar: Concentrated consumption can spike insulin levels resulting in fatigue and compromising cognitive functioning.
11. Breaking a sweat: Periodic cardiovascular exercise reduces toxic effects of prolonged stress and stimulates production of new hippocampal neurons which is important for learning and the formation of new memories.
12. Green leafy vegetables: Veggies like kale, collards, chard and spinach have high levels of antioxidants which protect the brain from daily wear.
13. Dark chocolate: One of the highest antioxidant foods for brain protection.
14. Being social: Engaging people exercises diverse areas of the brain keeping cognitive processes active and fit.
15. Dancing: Dancing is social, exercises balance and coordinating movement; all of which are good for the brain.
16. New Languages: Learning a new language pushes the limits of knowledge and contributes to the cognitive reserve, helping to prevent and slow the effects of mental decline.
17. Rhyming: Rhyming incorporates what you would like to remember into a rhyme to help with later recall.

18. Associations: Associating what you would like to remember with an environment, feeling, or person will help recall on demand.
19. Excessive alcohol: Avoid it. More than a couple of drinks a day have been linked to brain shrinking and mental decline.
20. Smoking: Avoid it. Smoking constricts brain arteries limiting available oxygen. Decreased densities of brain gray matter and higher incidence of strokes have been noted.
21. Relaxing: Excess stress causes brain damage. The hippocampus which is responsible for consolidating new memories is especially sensitive to stress.
22. Game playing: Playing games, online or otherwise, can stretch the mind and help build adaptive neural networks.
23. Rehearsing: Rehearsing new information to yourself or aloud to others helps to reinforce the associated neural networks and learning.
24. Meditation: Periodically calming and focusing the mind has been shown to help with attention, processing speed, response time, and to relieve stress.
25. Paying attention: Paying attention is the foundation of good memory.

Your brain needs a workout to stay healthy and to maintain peak performance. Scientifically designed brain games are a great option. You can have fun and improve your brain health at the same time. There has been a reported increase in memory, concentration and attention. [www.getbraingames.com](http://www.getbraingames.com) (Lumosity free trial)

WEEK SEVEN:

[http://www.ted.com/talks/shawn\\_achor\\_the\\_happy\\_secret\\_to\\_better\\_work.html](http://www.ted.com/talks/shawn_achor_the_happy_secret_to_better_work.html)

### Emotional Intelligence and Positive Thinking

We are exploring the “happiness advantage” and how it relates to positive psychology and success.

1. The lens through which the brain views the world shapes reality. If you change the lens, you can change your happiness and every single education and business outcome at the same time.
2. The external world is not predictive of happiness levels. 90% of happiness predicted by the way your brain processes the world. Two weeks after being happy about being at Harvard, the brain refocuses on competition, workload, hassles, stresses and complaints.
3. Only 25% of job successes are predicted by IQ. 75% of job successes are predicted by optimism levels, social support, and the ability to see stress as a challenge instead of a threat.
4. If you change your formula for happiness and success, you can change the way that you can then affect reality. Reverse the formula for happiness and success to get to health.

The following formula for happiness is scientifically broken and backwards: “If I work harder, I’ll be more successful. If I am more successful, I will be happier.”

The above formula is wrong because each time the brain has a success, you just changed the goal post on what success looked like. For example, you get good grades and now you need better grades to be successful. If happiness is on the other side of success, you never get there. We, as a society, have pushed happiness over the cognitive horizon.

5. If we raise the level of positivity in the present, then the brain experiences the “happiness advantage” which means the brain positive performs significantly better than the negative, neutral or stressed brain. Intelligence and creativity rise, energy rises, and every single outcome improves.

Positive brain:           31% more productive  
                                  37% better sales  
                                  19% physicians were faster and more accurate

6. We need to reverse the formula for happiness and success to see what our brains are capable of. Dopamine rises when positive. It makes you happier and turns on all learning centers in the brain allowing you to adapt to the world in a different way.
7. There are ways to train the brain to be more positive.

2 minutes for 21 consecutive days can rewire the brain allowing the brain to work more optimistically and more successfully. Write down 3 new things you are grateful for 21 days in a row. Your brain will retain the pattern of scanning the world for positive first.

Journaling one positive experience over the last 24 hours allows the brain to relive it.

Exercise teaches your brain that behavior matters.

Meditation allows the brain to get over the cultural ADHD we have been creating by multitasking. Focus on the task at hand.

Perform random or conscious acts of kindness. For example, write a positive email praising/thanking someone in your social support network.

By doing these activities and training the brain, we can reverse the formula for happiness and success; and create ripples of positivity and a real revolution.

Research: (Bandura, 1977; Bar-on et al., 2003; Cherniss & Extein, 2006; Neubauer & Fink, 2009; Palmer et al., 2001; Pool & Qualter, 2012; Tsaousis & Nikolaou, 2004; Zeidner et al., 2008)

Other videos:

- 1) An additional video on mindfulness was included as an elective within the weekly lessons. The web address was:  
<http://www.youtube.com/watch?v=YvOiSbEj8hQ&feature=related>
- 2) Humor and inspirations videos were at this web address:  
[http://www.drjanrichards.com/inspiration\\_groups](http://www.drjanrichards.com/inspiration_groups)
- 3) Entertainment was provided at the following web addresses:
  - a. <http://www.youtube.com/watch?v=MNjTceSGDeU>
  - b. <http://www.youtube.com/watch?v=EX5nNVuxvFs>
  - c. <http://www.geocaching.com/>



## Weekly Outlines:

### Week One:

- Take a few minutes and explore this website
- Read the “DID YOU KNOW” section
- Watch the video on the introduction to the brain
- Take the Creativity survey to learn about your preferences for creativity and problem solving (the survey will be compiled and your creativity report will be issued to you in week two)
- Create a to do list
- Go to the SELF-REPORT page and respond to the weekly self-report form
  - NOTE: the self-report form will ask questions about site content to determine if students followed the instructional plan

### Week Two:

- Find and watch a humorous clip from Dr. Richards collection of funny video clips
- Read the “DID YOU KNOW” section
- Watch the video on perseverance
- Go to the SELF-REPORT page and respond to the weekly self-report form

### Week Three:

- Find and watch a humorous clip from Dr. Richards collection of funny video clips
- Read the “DID YOU KNOW” section
- Watch the video on the eight secrets to success
- Go to the SELF-REPORT page and respond to the weekly self-report form

### Week Four:

- Find and watch a humorous clip from Dr. Richards collection of funny video clips
- Read the “DID YOU KNOW” section
- Watch the video on how nutrition impacts brain functioning
- Go to the SELF-REPORT page and respond to the weekly self-report form

### Week Five:

- Find and watch a humorous clip from Dr. Richards collection of funny video clips
- Read the “DID YOU KNOW” section
- Watch the video on self-determination theory
- Go to the SELF-REPORT page and respond to the weekly self-report form

### Week Six:

- Find and watch a humorous clip from Dr. Richards collection of funny video clips
- Read the “DID YOU KNOW” section
- Watch the video on 25 tips for memory improvement
- Go to the SELF-REPORT page and respond to the weekly self-report form

Week Seven:

- Find and watch a humorous clip from Dr. Richards collection of funny video clips
- Read the “DID YOU KNOW” section
- Watch the video on emotional intelligence and positive thinking
- Go to the SELF-REPORT page and respond to the weekly self-report form
- At the end of this week, you may take the final two surveys. Just click the link for each.

Week Eight:

- Find and watch a humorous clip from Dr. Richards collection of funny video clips
- Read the “DID YOU KNOW” section
- Go to the SELF-REPORT page and respond to the weekly self-report form
- You may take the final two surveys. Just click the link for each.

## APPENDIX F: SELF-REPORT EXAMPLE

Please take a few moments and document your progress each week.

# 1. Were you able to complete all of your course assignments? You may select multiple answers. Choose one:

Some were completed; Reading assignments were completed; Discussion board assignments were completed; All assignments were completed; I did more that required

# 2. Did you create a to do list for this week to help you focus on goals and tasks?

Choose One: No yes

# 3. Has this week's lesson enabled you to become more intrinsically motivated?

Choose one:

Strongly Disagree; Disagree Moderately; Disagree Mildly; Disagree; Undecided; Mildly Agree; Moderately Agree; Agree; Strongly Agree

# 4. Did the relationship to the Bible's guidance on perseverance enable you to have a higher persistence level? Choose one:

Strongly Disagree; Disagree Moderately; Disagree Mildly; Disagree; Undecided; Mildly Agree; Moderately Agree; Agree; Strongly Agree

# 5. Was this week's lesson helpful? Choose one:

Strongly Disagree; Disagree Moderately; Disagree Mildly; Disagree; Undecided; Mildly Agree; Moderately Agree; Agree; Strongly Agree

# 6. How satisfied are you with the information on the site? Choose One:

Strongly Dissatisfied; Dissatisfied Moderately; Dissatisfied; Mildly Dissatisfied; Dissatisfied; Mildly Satisfied; Moderately Satisfied; Strongly Satisfied

# 7. Has this site helped you cope with the difficulty of this course? Choose one:

Strongly Disagree; Disagree Moderately; Disagree Mildly; Disagree; Undecided; Mildly Agree; Moderately Agree; Agree; Strongly Agree

# 8. What area of this website did you find most useful?

INSPIRATION AND HUMOR; BRAIN FACTS; VIDEO CLIPS; GUIDANCE SECTION; EDUCATIONAL NEWS; OTHER

Page 2 of Weekly Self-Report Form

# 9. Add any comments that you would like to share with me that could improve the course or this website

Week 2 Comments:

# 10. Enter your EDUC Course Code

Choose One: EDUC 712 EDUC 715 EDUC 817 EDUC 819

# 11. Please enter your name below