Examining the Self-Efficacy Perceptions of Adults Who Completed a ThinkRx One-on-one Brain Training Program

Submitted by

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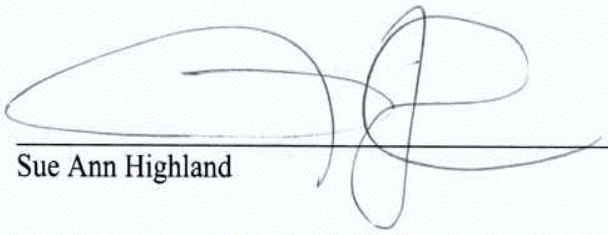

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Date

Abstract

The purpose of this study was to examine the perceptions of adults who completed a LearningRx ThinkRx program. Organizations and employees often deal with low levels of self-efficacy, which can lead to lower levels of performance. Specifically, this study question was an examination of perceptions related to workplace self-efficacy. Brain training research has been shown to help increase academic skills, but little research has been conducted with self-efficacy and adults. The sample in this study were adults who completed their program between the years 2015 and 2018. The sample was chosen using purposeful sampling procedures among all participants who are now adults and completed their program between 2015 and 2018 at the [redacted] LearningRx center. Three forms of data were collected: artifact data, participant interviews, and member checking interviews. This qualitative case study examined the data using a thematic data analysis. The five themes found in this study were self-awareness, problem solving, emotional control, achievement, and leadership. There was direct support for the research question from the themes of self-awareness, problem solving, and emotional control. Though achievement and leadership did not directly support this research, futures researchers could explore if there is a connection between workplace self-efficacy and the these final two themes.

Keywords: brain training, cognitive training, LearningRx, adult self-efficacy, self-efficacy

Dedication

This dissertation is dedicated to my family first. My family has been with me through this journey and has never given up on the process. I could not have done this without all of you! I love you with all my heart and I promise not to take my computer with me on family vacations to sit by the pool and write (unless it is writing my next book). Second, this is dedicated to the adults who had the courage to try something new and different to make a positive impact on their lives. Finally, I would like to dedicate this to all the people who were my cheerleaders along this journey. I appreciate your support.

Acknowledgments

First and foremost, I would like to thank my entire family for their amazing support during this journey. Without their unending support, I would not have made it through this process. Family sacrifices are often overlooked and unappreciated. My husband is the person who encouraged this journey, but little did he know, he would be going on this journey with me. Over 25 years of marriage and I appreciate him more and more every day. My children, who inspire me daily, have stood by me and encouraged me, even while writing on family vacations. I also could not have done this without my parents always encouraging me to continue my education to reach my goals.

I would also like to thank my committee for their guidance throughout this process. I would also like to thank my chair, Dr. Miller, for not giving up when the process was difficult. This is the most humbling and rewarding experience I have undergone. I would not have made it without her guidance. My other committee members are amazing scholars and I am blessed to have them in my corner.

Finally, I would like to thank Mary, the inspiration for my research. I was blessed to have met this amazing woman many years ago. Her drive, ambition, will to push through the hard times, love of helping people, and love of travel inspire me to keep pushing to be my best. Thank you, Mary, for being you. This research is for you to be able to share with others and hopefully inspire them to seek help and improvements.

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Chapter 1: Introduction to the Study

Introduction

Self-efficacy is a person's belief in his or her own abilities, particularly in the workplace. This belief is critical to an employee's performance in the workplace environment. One-on-one brain training programs are interventions that have been designed to increase cognitive abilities in individuals. Perceptions about workplace self-efficacy after an adult has completed brain training are not known. Controversy exists concerning online brain games and the brain training industry. The brain training industry presents multiple definitions and purposes for brain training. The definition used in this research is one-on-one intensive training that uses short exercises targeting specific cognitive skills.

Some scientists do not feel brain training programs effectively increase cognitive skills or feel that these skills do not transfer into real life (Harrison et al., 2013; Max Planck Institute for Human Development and Stanford Center on Longevity, 2014). This study was designed to fill the gap in knowledge by considering a connection between brain training and adult self-efficacy. The purpose of this study was to determine what perceptions adults have concerning self-efficacy, specifically in the workplace, after completing a ThinkRx one-on-one brain training program. This was a case study conducted using data from a [redacted] LearningRx Brain Training Center.

This chapter will serve as an introduction to the problem, research questions, theoretical frameworks, and rationale for the study. This chapter will also provide definition of major terms used in this researh, assumptions, limitations, and delimitations

of the study. This chapter will also provide the background for the study and the research timeline.

Background of the Study

The research on self-efficacy, brain training, cognitive skills, and workplace performance is plentiful. Historically, employers have tried to discover ways to improve the self-efficacy of their employees. However, there are no known studies exploring the self-efficacy perceptions of adults who have completed a brain training program. This section describes the information providing background for the research. Self-efficacy was the specific phenomenon studied, and brain training was the program in which each study subject participated. This researcher included cognitive skills in the workplace to explore other research that may show effects on self-efficacy. All three areas are important as a foundation for this research.

Self-efficacy. There was a need to learn if adults perceived changes in self-efficacy after they completed one-on-one brain training. For the purposes of this study, self-efficacy was defined as a person's belief they can perform successfully and have a level of self-confidence (Bandura, 1977; Bandura, 2008; Bandura, 2012; Lunenburg, 2011). Self-efficacy is important for adults as they navigate through their work lives. This helps them choose goals, influences their effort, and affects persistence (Lunenburg, 2011). Employees with higher self-efficacy have been shown to have better job satisfaction, job performance, and health (Burns & Christiansen, 2011; Cherian & Jacob, 2013; Lunenburg, 2011). Current research points to ways people can develop their self-efficacy, but these pertain mainly to activities they can do themselves or through social channels (Bandura, 1977, 2006, 2008, 2012). Some ways to do this include social

modeling, motivating oneself, believing in oneself, and making improvements. This may be different for people with low cognitive skills because they may not have experienced enough success to foster motivation.

Brain training. Brain training is a set of mental exercises that can be delivered one-on-one, by computer, or in small groups and target an individual's cognitive skills (LearningRx, 2016). Many commercial brain training programs exist in the market, including CogMed, Lumosity, Brain Balance, LearningRx, Cognifit, and BrainHQ, among others (Astle, Barnes, Baker, Coldough, & Woolrich, 2015; Ballesteros, Mayas, Prieto, Ruiz-Marquez, Toril, Reales, 2014; Ballesteros, Mayas, Prieto, Ruiz-Marquez, Toril, Reales, 2017; Bergman-Nutley & Klingberg, 2014; Carpenter, Ledbetter, Moore, 2016; Moore, Carpetner, Miller, & Ledbetter [in press]; Jaeggi, Buschkuehl, Jonides, Perrig, 2008). These programs may target as few as one cognitive skill or as many as nine. Though there are many commercially available products, the LearningRx program was the focus of this study. Brain training, or cognitive rehabilitation, has also been shown to improve cognitive function in people after brain injuries (Stanescu & Dogaru, 2016). These improvements have been shown in memory, language, judgement, attention, and spatial perception.

Researchers have examined the effects of online brain training and cognitive skills (Bigorra, Garolera, Guijarro, & Hervás, 2016; Lampit, Hallock, & Valenzuela, 2014; Span, 2016). There are vast differences between online brain training programs and one-on-one training (Astle, Barnes, Baker, Colclough, & Woolrich, 2015; Bozoki, Radovanovic, Winn, Heeter, & Anthony, 2013; Gibson, Carpenter, Moore, & Mitchell, 2015; Haesner et al., 2015; Schubert, Strobach, & Karbach, 2014). Online games are used

in an uncontrolled environment and only focus on a few skills (Bigorra, Garolera, Guijarro, & Hervás, 2016; Lee, Kim, & Yoo, 2017; Span, 2016). Anyone can purchase brain games and can choose the games they want to play and the amount of time to play each game. The key components of effective brain training are: repetition, progressive drills, positive and corrective feedback intensity, distractions, sequencing, and loading (Carpenter, Ledbetter, & Moore, 2016; Gibson, 2007; Jedlicka, 2012, 2017).

Cognitive abilities and workplace performance. Cognitive ability is one predictor of job performance, producing higher levels of self-efficacy (Murphy, 2009; Schmidt & Hunter, 1998). Cognitive training done on two specific cognitive skills has shown positive results in adults (Nouchi et al., 2013; Nozawa, et al., 2015). In addition to adults, researchers conducted a randomized controlled group study of the effects of the LearningRx program with students ages 8-14 (Carpenter, Ledbetter, & Moore, 2016). These results showed a 21-point standard scale gain in general intellectual ability, while the control group had a 5.11-point standard score loss. Another study showed children gained cognitive, academic, and life benefits from the LearningRx program (Jedlicka, 2012, 2017). Though these results are promising, few researchers have studied programs that cover all cognitive areas or their effects on adults, other than the LearningRx program.

There is research providing background on cognitive training and self-efficacy showing positive results as standalone studies. Self-efficacy has been shown to increase work performance (Bandura, 1977, 2006, 2008, 2012; Hunt & Madhyastha, 2012). Cognitive ability is a predictor of job performance, producing higher levels of self-efficacy (Schmidt & Hunter, 2004). However, no connection between the two has been

established. This study was an attempt to bridge this gap between cognitive training and self-efficacy in the workplace.

Problem Statement

It was not known if adults who graduated from a ThinkRx, in-person, one-on-one brain training program perceived self-efficacy changes in their lives. Self-efficacy leads to higher performance in the workplace, as do higher cognitive skills. Organizations and employees often deal with low levels of self-efficacy, which can lead to lower levels of performance (Pari, S., & Kumar, P., 2010). However, if employees are in the workforce and want to gain promotions, is there a method for gaining those higher levels of self-efficacy? Can gaining higher levels of cognitive skills impact their self-efficacy in the workplace, therefore helping them to increase their confidence in their own abilities?

Employers implement training programs in the workplace to help employees learn new skills needed in their positions. Employers will often implement continuing education to help employees learn new skills for other positions that might be of interest in the workplace (Abraham, 2012; Adkins, 2015). However, employers do not typically implement cognitive skills training programs or programs that help increase self-efficacy. There has been a rise in employee wellness programs but not ones specifically targeting self-efficacy.

Giving employees an option of increasing cognitive skills and, in turn, self-efficacy, allows employees to increase their productivity (Bandura, 2012; Burns & Christiansen, 2011). Employees may also choose to increase their skills to advance in the workplace. Either way, increasing self-efficacy provides the first step, belief, to improvement in the workplace. The general population affected by poor self-efficacy are

adults with low cognitive abilities and adults who want to improve work performance. This study was designed to provide a possibility for adults to consider if they would like to change their impressions about their workplace self-efficacy.

Purpose of the Study

The purpose of this qualitative case study was to determine what the self-efficacy perceptions are for adults who completed a ThinkRx brain training program between 2015 and 2018 at the LearningRx center in [redacted]. This research was a qualitative case study using inductive analysis to examine the collected data. The three forms of data that were collected were exit artifacts, a participant interview, and a member checking interview. Self-efficacy, including people's beliefs in their workplace abilities, was the phenomenon studied in this research (Bandura, 1977, 2006, 2008, 2012). This study did not include a survey or self-rating system to determine the levels of self-efficacy, but it did include participants' reports on their own perceptions of their lives. Participants were asked to reflect both on their lives prior to doing a LearningRx program and current day.

Self-efficacy is different from self-confidence or self-esteem. It is the deep belief in one's own abilities to achieve in the workplace. Self-efficacy encompasses several other ideas, such as determination, risk taking, effort, self-advocacy, confidence, and believing in one's future. This study looks to bridge the gap between brain training research and research on the self-efficacy of adults. Bridging this gap may provide another option to people seeking to improve their workplace skills.

Research Question

The phenomenon studied was the self-efficacy of adults in their workplace. Self-efficacy was defined by Bandura as a person's belief in his or her own abilities, specifically in work performance (Bandura, 1977, 2006, 2008, 2012). This study was an examination of self-efficacy in the participants' workplace lives. Self-efficacy is a predictor of workplace success; therefore, examining a possible way to increase self-efficacy could be useful for employers and employees alike. The following research question served as a guide in this qualitative study:

$RQ_{1:}$ How do adults who completed a ThinkRx brain training program perceive their workplace self-efficacy?

This research question was answered by examining artifacts from LearningRx, conducting an interview, and conducting a follow-up member checking interview. The data were analyzed using inductive analysis. This research question relates to the problem because it is specifically looked at the self-efficacy perceptions of adults who have completed a ThinkRx program. By examining the perceptions, this researcher was able to discover if self-efficacy was a common theme with each adult.

Advancing Scientific Knowledge and Significance of the Study

This research added to the body of research on workplace self-efficacy by providing a possible approach for increasing self-efficacy. It also provided a possible option for employees to increase their self-efficacy, specifically in the workplace. The research added to the body of knowledge on ThinkRx by providing additional research on the possible benefits of this program. Continued research in the area of special education with cognitive skills training as an early intervention for children should be explored.

This research is significant because both businesses and employees may benefit. Businesses may potentially use this training to assist employees who are struggling in a workplace. If employees wish to explore ways to increase their performance, gain new employment, or seek new employment, this could provide an opportunity for possible assistance (Krumm et al., 2014; Mayer & Skimmyhorn, 2017; Richardson & Norgate, 2015). LearningRx brain training has not been explored as an employee intervention program. Further exploration of this program may provide additional benefits for both employees and businesses.

Rationale for Methodology

Methodology. Qualitative methodology was chosen for this research study. Qualitative methodology is a systematic approach that is more subjective in nature and used to describe experiences and provide meaning. This methodology is exploratory, using documents, artifacts, and interviews to discover trends and themes within a phenomenon (Babbie, 2010; Stake, 1995, 2005, 2006; Yin, 1981, 2011, 2018). Qualitative research is considered exploratory research, so it is appropriate for analyzing for themes. Purposeful sampling of study participants also supports a qualitative methodology because it allows for choosing specific experiences shared by all participants (Stake, 1995, 2005, 2006; Yin, 1981, 2011, 2018). Qualitative methodology gives a researcher the ability to answer a research question using nonnumeric data and answering the questions why and how. Quantitative research focuses on the what of the data. By using this methodology, this researcher was able to describe the data from the participants' points of view. This makes this research method more personal because the reader is able to get to know each participant. This is simply an explanation of the

participants' situations, not a discussion about improvements based on an IQ score. Because there are over 80 LearningRx centers across the United States, the LearningRx participants and locations were specifically chosen for this study. The researcher was interested in hearing and understanding these perceptions from the participants and was not concerned with measuring data.

Quantitative methodology considered. Quantitative methodology is a systematic process that gathers data to test relationships, examine cause and effect, or describe relationships between sets of data. This methodology was not chosen for several reasons. If this researcher would have been considering the cognitive scores that impacted self-efficacy, then quantitative methodology would be an appropriate choice. Cognitive ability scores were not being considered as a factor in this study. Also, there was not a control group for this study, so conducting a quantitative study would not have been an appropriate choice for this research (Johnson & Christensen, 2008; Lichtman, 2006). Quantitative research methodology helps a researcher look at cause and effect and make predictions about a data set. The research question in this study did not seek to discuss this type of data. The research question was designed neither to seek these types of relationships between the data, nor to collect objective data.

Mixed methodology considered. Mixed methodology is the use of both qualitative and quantitative methods in one study. It uses both methods to connect and describe the collected data. Mixed methodology has not been chosen for this study because it collects both qualitative and quantitative data, while this research collected only the qualitative perspectives of the adult graduates of the ThinkRx program (Doyle, Brady, & Byrne, 2009). A mixed methodology study also requires the use of quantitative

data and no quantitative data were collected in this study. This study was not designed to make predictions or examine cause and effect in the research question.

Nature of the Research Design for the Study

Case study was chosen for this study. Case study is a qualitative method that does not always include interviews but does involve an in-depth analysis about a chosen group or individual (Eisenhardt, 1989; Stake, 1995, 2005, 2006; Yin, 1981, 2011, 2018). Using the participant's own story allows the researcher to begin with specific instances to use for general conclusions (Park & Park, 2016; Stake, 1995, 2005, 2006; Yin, 1981, 2011, 2018). By using the self-reported exit marker, a researcher can examine data that were collected upon completion of the intervention. This contributed to the accuracy of the information provided by each participant. The researcher used a follow-up interview to collect both reflective data and current real-life transfer of skills. Collecting data from the first-hand experiences of the participants allows for novel perspectives on the chosen phenomenon (Cassel & Symon, 2015; Yin, 1981, 2011, 2018).

Case study design generates new theory from data (Beach & Brun Pedersen, 2016; Johnson & Christensen, 2008; Stake, 1995, 2005, 2006; Yin, 1981, 2011, 2018). It begins by focusing on natural settings to understand relationships among phenomena. The researcher attempts to interpret these phenomena based on the meaning the participants bring to their situations. Patterns are explored within the stories collected to seek out themes (Babbie, 2013; Frost, 2013; Stake, 1995, 2005, 2006; Yin, 1981, 2011, 2018). This single case study design was chosen to explore a group of people who have experienced a shared event, a ThinkRx program (Frost, 2013; Stake, 1995, 2005, 2006;

Yin, 1981, 2011, 2018). It is ideal to study this phenomenon because it is currently underrepresented in research.

Descriptive case study design is an assessment of a sample in detail and in depth, based on a theory (Yin, 1981, 2011, 2018). The phenomenon is scrutinized by the questions that are asked both in the research question and the questions the researcher asks. Traditional case study design can explore a group, phenomenon, or individual from multiple perspectives (Babbie, 2013; Frost, 2013). The other types of case study design considered were explanatory, instrumental, and causal. The explanatory design was not chosen because the researcher did not compare between two explanations to answer a question. This did not fit the research question used. Instrumental design was not chosen because the research question was not directed at a specific instrument; it was directed at a participant's perception about a program. Causal design was not chosen as the case study design because the research question was not asking for the cause of the perceived changes, but just a description of the changes.

Descriptive case study. Specifically, a descriptive case study design was chosen for this study for several reasons. First, a case study allowed the researcher to gain the story from each participant to explore any themes they presented through their self-reported changes and improvements (Babbie, 2013; Beach & Brun Pedersen, 2016; Frost, 2013; Stake, 1995; Stake, 2005, 2006; Yin, 1981, 2011, 2018). Second, there were over 300 adult participants, so the time and cost to conduct direct interviews would have been limiting. By gathering information-rich artifacts derived from each participant's program, the researcher hoped to hear their story. These artifacts, part of the participants' stories, are exit documents used in all LearningRx programs (Stake, 1995, 2005, 2006; Yin,

1981, 2011, 2018). Additionally, the researcher conducted interviews with each participant to gain additional information about transfer of skills and self-efficacy. Finally, member checking interviews were conducted after the initial analysis was completed.

In this study, the unit of analysis was defined as the group of adults who completed a LearningRx program at a [redacted] center (Yin, 1981, 2011, 2018). This bounded system was comprised of individual adults who completed the program. Yin suggested there are four types of design: single holistic design, single embedded design, multiple holistic design, and multiple embedded design. The design consists of five components: research question, propositions, unit of analysis, the link between data and propositions, and criteria for interpretations.

This descriptive case study design was more appropriate than other designs because themes were discovered using the shared experiences of the participants in the ThinkRx program (Babbie, 2013; Frost, 2013; Stake, 1995, 2005, 2006; Yin, 1981, 2011, 2018). Self-efficacy is best understood by listening to people's beliefs in their own words (Bandura, 1977, 2006, 2008, 2012). Themes cannot be examined through data from Woodcock-Johnson III Test of Cognitive Abilities, and the voices of the adult participants cannot be represented (HMH, 2015). This case study allowed for deep examination of self-reported life and workplace improvements that would not be found in a test score. The descriptive case study design allowed the researcher to explore this particular phenomenon directly and describe this particular group of individuals. Other designs would be more general and may not have allowed for exploration of this phenomenon as deeply. If the researcher were to design this case as all people who

completed a program, it would not allow for exploration of the work environment because many of the clients are children. Self-efficacy was specifically defined in this research as belief connected to the work environment, which does not pertain to children.

Definition of Terms

Several terms were used in this case study and are defined as follows:

Cognitive ability. Cognitive ability is the combination of cognitive assessment sub scores based on the Cattell-Horn-Cattel Theory of Intelligence (Flanagan & Harrison, 2012; Hoelzle, 2008). In the LearningRx brain training program this is measured by the Woodcock-Johnson III Cognitive Skills Assessment (HMH, 2015; LearningRx, 2015).

Learning Rx Brain Training. LearningRx brain training is a set of mental exercises that are delivered one-on-one and target cognitive skills (LearningRx, 2016).

Self-efficacy. Bandura defined self-efficacy as a person's belief in their own abilities, specifically regarding their work performance (Bandura, 1977, 2006, 2008, 2012).

Transfer effect. Transfer effect is the ability to extend into one or more contexts what is learned and practiced in another context (Nouchi et al., 2013). In this research, this is the use of improved cognitive skills into everyday life.

Cattell-Horn-Carrol theory of abilities. The Cattell-Horn-Carrol theory of intelligence states that intelligence is made up of multiple cognitive skills, including quantitative knowledge, fluid reasoning, short-term memory, long-term retrieval and storage, visual processing, auditory processing, and processing speed (Flanagan & Harrison, 2012; Hoelzle, 2008; Schneider & McGrew, 2012). This theory states cerebral efficiency is the core of intelligence (Richardson & Norgate, 2015).

Neuroplasticity. The ability of the brain to grow new neural connections, reorganize and adapt (Stiles, 2000). This brings about change in the brain on both a functional and/or structural level.

Brain training/cognitive training. Enhacing or sustaining cognitive function through deliberate cognitive exercises (Rabipour & Raz, 2012; Simons et al., 2016). The goal of brain, or cognitive, training is to improve performance in cognitive abilities so improvements transfer to other life skills.

Computerized brain training games. Games conducted on the computer that address one or more cognitive skill areas by an individual (Simons et al., 2016).

Limitations, Delimitations, and Assumptions

Limitations and delimitations were present within the research. Limitations are influences over which the researcher has no control, whereas delimitations are choices the researcher may have put into the research, whether limits or boundaries (Simon & Goes, 2012). Assumptions are things the researcher assumes as being present within the study or dealing with participants. The following limitations and delimitations were present in this study:

Limitations.

1. Interviews may have made the participant uncomfortable, therefore not allowing them to be completely honest during the interview.
2. Because the artifact data are pre-existing, the researcher would not have to opportunity to question or clarify data. This is a secondary set of information that was collected from all clients and their families during the LearningRx program.
3. Purposeful sampling may have limited the amount of data collected. This also limited the ability to generalize the data to a larger population.
4. Sample size may be small so the data might have been limited.

Delimitations.

1. Geographical location of research participants was delimited because purposeful sampling was utilized and only one location was chosen for convenience of the researcher.

2. The timeline of the participants' programs was a delimitation because they all participated between 2016 and 2018. Because the programs are completed, these artifact data were historical in nature.

3. The program chosen for this study was the LearningRx Brain Training program. Other programs were ruled out because of the scope and individual nature of the LearningRx program. Generalization to other programs labeled as brain training may not be warranted.

4. Purposeful sampling in the design was chosen to isolate self-efficacy in the workplace so children were eliminated in the sample because they do not typically work.

5. Value coding has inherent possibility of bias because it was the researcher's decision about the codes utilized.

Assumptions.

1. It was assumed the participants were truthful during the interviews.

2. It was assumed the artifacts that were collected from the [redacted] LearningRx center were complete and unaltered.

Summary and Organization of the Remainder of the Study

This chapter discussed the research questions, methodology, design, data, and analysis. This qualitative descriptive case study explored the self-efficacy improvements of adults who completed a ThinkRx brain training program at LearningRx centers in [redacted]. Though other methodologies were considered, case study design was deemed most appropriate. The research was conducted by collecting existing artifacts from the LearningRx center in [redacted] pertaining to adults who completed a ThinkRx cognitive skills program between 2016 and 2018. These documents included self-reported perceptions about their ThinkRx program. Additionally, the researcher

conducted interviews and member checking interviews with willing participants. Self-efficacy was generally defined as a person's belief in his or her own ability, specifically in work performance (Bandura, 1977). Once data were collected, they were coded using a value code process, and an inductive analysis was conducted.

Chapter 2 will review the published literature that shows support for this research, including the theoretical foundation and identification of the gap. Chapter 3 will discuss the methodology that will be used in this research, the research questions, design, population and sampling, sources of data, and the analyses that were conducted. Chapter 4 will present the procedures for analysis and how the findings answer the research questions. It will present the characteristics of the study sample and describe the study results. Finally, Chapter 5 will discuss the research findings and provide a summary. It will also provide recommendations for further research and study implications.

The research timeline was as follows:

- December 6, 2018: IRB approval received
- December 7, 2018: Artifact data request was sent to the [redacted] LearningRx Program Director.
- December 8, 2018: Participants were contacted for interviews by the researcher.
- December 2018: Artifact data, with deidentification, were collected from the [redacted] center.
- December 2018: Initial inductuive thematic analysis were conducted.
- January 2019: Member checking interview were conducted.
- February 2019: Final inductive analysis were conducted.
- August-September 2019: final AQR and defense.

Chapter 2: Literature Review

Introduction to the Chapter and Background to the Problem

This chapter is a review of the literature on brain training research and perceptions of self-efficacy in the workplace. Researchers have studied the impact of cognitive skills in the workplace, the impact of self-efficacy in the workplace, brain health, and brain training programs (Bandura, 1977, 2006, 2008, 2012; Bergman-Nutley & Klingberg, 2014; Carpenter et al., 2016; Haesner, O'Sullivan, Govercin, & Steinhagen-Thiessen, 2015; Lampit, Hallock, & Valenzuela, 2014; Van de Ven et al., 2017). Brain training will be defined in this review as computer-based or face-to-face interventions designed to increase specific cognitive skills in individuals (Astle, Barnes, Baker, Colclough, & Woolrich, 2015; Bozoki, Radovanovic, Winn, Heeter, & Anthony, 2013; Gibson, Carpenter, Moore, & Mitchell, 2015; Haesner et al., 2015; Schubert, Strobach, & Karbach, 2014). Researchers of brain training have explored improvements in both children and adults. However, little research exists on the perceptions adults have of one-on-one brain training programs and their own self-efficacy in the workplace.

For this literature review, search terms including *adult perceptions* and *LearningRx*, *LearningRx* and *workplace*, *self-efficacy*, *brain training*, and *adult perceptions of workplace self-efficacy* yielded few results. Literature was surveyed in databases such as LopeSearch, Google Scholar, Science Direct, ProQuest Central, ProQuest Dissertations, ProQuest Education Journals, ProQuest Health and Medical Complete, ProQuest Psychology Journals, PsycInfo, Sage Research Methods, PubMed, ERIC, Mental Measurements Yearbook, Queensland University of Technology ePrints, and Ebsco. Additional search terms included *brain training*, *neuroplasticity*, *cognitive*

skills, *self-efficacy*, *workplace self-efficacy*, *workplace skills*, *computerized brain training*, *one-on-one brain training*, *LearningRx brain training*, and *online brain training programs*. Combinations such as *LearningRx* and *self-efficacy*, *online brain training* and *self-efficacy*, and *cognitive skills* and *self-efficacy* were also searched in these databases.

This literature review will examine specific research on brain training for both children and adults, online brain training, one-on-one brain training, brain health, intelligence, measurements of job performance, and self-efficacy in the workplace. I will also include discussion of the Cattell-Horn-Carroll model of intelligence, brain training, LearningRx brain training, cognitive abilities' impact in the workplace, and self-efficacy. Subsections of the review will include the theoretical foundations of Bandura's self-efficacy theory, social cognitive theory, and the causal model of cognitive ability in the workplace.

Researchers have examined the effects of online brain training and cognitive skills; however, these online brain games are not the same as one-on-one brain training (Burki, Ludwig, Chicherio, & De Ribaupierre, 2014; Haesner et al., 2015; Lampit, Hallock, & Valenzuela, 2014). There are vast differences between online brain training programs and one-on-one training (Haesner et al., 2015; Nouchi et al., 2013; Rabipour & Raz, 2012). Online games are used in an uncontrolled environment, only focus on a few skills, and are not necessarily based on a person's cognitive needs (Haesner, O'Sullivan, Govercin, & Steinhagen-Thiessen, 2015; Span, 2016; West, Wong, Minero, & Pumaccahua, 2014). Anyone can purchase brain games, choose the games they want to play, and decide how much time to spend playing each game. Researchers have provided background on cognitive training and self-efficacy (Astle, Barnes, Baker, Colclough, &

Woolrich, 2015; Ledbetter, Moore, & Mitchell, 2017; Thompson & Gomez, 2014). Self-efficacy has been shown to increase work performance (Hunt & Madhyastha, 2012). Cognitive ability has been shown to be a predictor of job performance, producing higher levels of self-efficacy (Schmidt & Hunter, 2004). However, no interaction between the two has been established. This chapter will identify the gaps in the literature, provide the theoretical foundations for the research, provide a review of the literature, and summarize the information provided.

Identification of the Gap

The research and theoretical background about cognitive skills gaps is extensive but demonstrates the need for new research. Cognitive ability is the biggest predictor of employee job performance and plays a large role when an employee is learning new tasks. This is less of a predictor when performing familiar tasks (Murphy, 1989; Ree, Earles, & Teachout, 1994). Multiple indicators, including specific job aptitude and cognitive ability, must be taken into consideration in relation to performance and cognitive skills (Alessandri et al., 2015; Hunt & Madhyastha, 2012; Konen & Karbach, 2015; Richardson & Norgate, 2015; Schmidt & Hunter, 2004). Bandura's self-efficacy theory states when people can believe in their own capabilities, they are able to succeed at higher rates (Bandura, 1977; Bandura, 2012).

The research about cognitive skills gaps is extensive and demonstrates the need for new research (Astle et al., 2015; Bigorra et al., 2016; Carpenter et al., 2016; Enriquez-Geppert, Huster, & Herrmann, 2013; Hunt & Madhyastha, 2012). Some researchers purported that cognitive ability is the biggest predictor of employee job performance, although newer researchers have begun to call this in to question (Ahmed, Hidayat, &

Faisal-ur-Rehman, 2015; Schmidt & Hunter, 1998). Cognitive ability is important when an employee learns new tasks and less important when an employee performs familiar tasks (Bates, Thompson, & Bates, 2013; Murphy, 1989). Bandura's self-efficacy theory states when people believe in their own capabilities, they are able to succeed at higher rates (Bandura, 1977; Bandura, 2012). However, social cognitive theory states that people must exert intentional influence on their own cognitive functions and the actions that follow (Bandura, 2006; Bandura, 2008). Cognitive function is a person's cognitive abilities and how they are used in real life. If this is the case, then people must believe in themselves and then act on this belief. According to Bandura's theory, self-efficacy is developed in four ways: past performance accomplishments, modeled behavior, feedback from others, and physiological response (Bandura, 2012).

Cognitive ability is important in this theory because it helps a person to more easily acquire knowledge, which impacts performance (Hunt & Madhyastha, 2012; Joseph, Khess, & Singh, 2016; Schmidt & Hunter, 2004). If a person cannot easily acquire new knowledge, then he or she may not be able to make quick decisions, work at higher performance levels, or add new knowledge to a job. Lower level cognitive tasks tend to be more repetitive, less dependent on higher level thinking, and less creative in nature. These tasks do not necessarily depend on higher cognitive skill sets.

Newer researchers have called into question this correlation between cognitive ability and performance in the workplace (Krumm, Schmidt-Atzert, & Lipnevich, 2014; Oh, 2014; Richardson & Norgate, 2015; Scherbaum, Goldstein, Yusko, Ryan, & Hanges, 2012). Several factors should be considered when discussing the factors that may influence job performance, including impact of the environment and supervisory

performance ratings (Richardson & Norgate, 2015; Stanhope & Surface, 2014). The impact of IQ on job performance may be a factor because of the speed of job knowledge acquisition and complexity of tasks (Schmidt & Hunter, 2004). Self-efficacy, stress, motivation, anxiety, and energy may also affect job performance, while supervisory evaluations show little to no impact (Krumm, Schmidt-Atzert, & Lipnevich, 2014; Oh, 2014; Richardson & Norgate, 2015; Scherbaum, Goldstein).

Theoretical Foundations

The causal model of cognitive ability and job performance will contribute to the theoretical framework of this study (Gottfredson, 1997; Schmidt, Hunter, & Outerbridge, 1986). According to this theory, people perform at higher rates when they have higher cognitive abilities. Furthermore, people who have higher cognitive abilities choose to perform jobs that need higher abilities. My research will contribute to this body of research by attempting to show how adults who have completed one-on-one cognitive training perceive self-efficacy and work performance.

Another component of the study's theoretical framework is the Cattell-Horn-Carroll theory of intelligence (Flanagan & Dixon, 2014; Hoelzle, 2008; Schneider & McGrew, 2012). Many cognitive skills come together to create the notion of intelligence. The LearningRx program was built on this theory and uses the brain's natural neuroplasticity to make changes and improvements in a person's intelligence and, in turn, life (Stiles, 2000). This study's objective was to add to these theories by providing data showing real-life improvements that are perceived by adults who have completed the ThinkRx program, specifically in workplace self-efficacy.

Another theory used in this research is the causal model of cognitive ability and job performance (Schmidt, Hunter, & Outerbridge, 1986). This theory indicates people perform at higher rates when they have higher cognitive abilities. People who have higher cognitive abilities choose to perform jobs that need higher ability levels. Other general predictors, such as integrity tests, conscientiousness tests, biographical data meausures, and reference checks, have shown much lower correlations than cognitive ability (Hunt & Madhyastha, 2012; Schmidt & Hunter, 1998).

Job knowledge may be a mediator of task performance (Palumbo, Miller, Shalin, & Steele-Johnson, 2005). If this is the case, then predicting performance for someone who has no prior work experience will be difficult. Though this is something to take into consideration, it may not have much impact on all employees. Generally, it is agreed that job experience neither increases nor decreases cognitive ability (Schmidt et al., 1986). Another consideration is whether or not there is evidence of instability in performance meausures over time. Performance may be affected by factors such as interpersonal relationships, absenteeism, and behaviors that increase hazards in the workplace (Murphy, 2009).

Another theoretical foundation of this research is the Cattel-Horn-Carrol theory of intelligence (Hoelzle, 2008; Newton & McGrew, 2010). According to this theory, multiple cognitive skills work in conjuction to create intelligence. Cogntive ability is not based simply on one skill. Neuroplasticity is defined as the brain's ability to change (Lenn, 1992). Researchers once thought of plasticity as only occurring after an injury. However, new research has shown that it occurs when the brain is exercised using a specific approach (Carpenter et al., 2016; Pfister, 2012; Wass, 2015).

An additional theoretical foundation for this study is the social cognitive theory, which explains that a person is an agent in their own functionality (Bandura, 1977; Grusec, 1992; Ouweneel, Schaufeli, & LeBlanc, 2013). According to this theory, people exert intentional influence on their lives and the course of future events (Bandura, 2012). This theory also includes how self-efficacy is developed in a person's life. Brain training programs should address the four sources of self-efficacy: vicarious experiences (modeling), performance outcomes (mastery experiences), physiological feedback (emotional response), and verbal persuasion (encouragement; Bandura, 1977; Bandura, 2012).

Social cognitive theory is based on an agentic perspective, people influencing their own environments and behaviors (Bandura, 2006). This theory indicates people contribute to their environment and are not just products of it. Social agency contains four core properties: intentionality, forethought, self-reactiveness, and self-reflectiveness. Intentionality is forming an action plan and strategies to achieve goals. Forethought is the cognitive action of visualizing the future, setting goals, and anticipating outcomes. When a future is visualized, it is more likely to be achieved. Often, people with lower levels of self-efficacy cannot see past their current state. Self-reactiveness is the ability to regulate oneself. This is creating a course of action and developing self-motivation to move toward the goals that have been set and visualized. When one is aware and has a high level of self-efficacy, he or she reflects on actions, goals, and meaning to evaluate life. These are all metacognitive states.

Along with the four core properties, the social cognitive theory indicates people operate in three modes: individual, collective, and proxy (Bandura, 2006). The individual

mode is bringing one's own influence and actions to a situation, event, or environment. However, most people do not operate in isolation. They must interact with a collective environment. The collective mode is bringing one's individual influence, knowledge, skills, and thoughts into a collective situation to affect a situation. This must be accomplished by working together and believing in others' efforts. Proxy is influence over a situation. A person does this by influencing people who have the resources and abilities to act on their behalf.

Review of the Literature

The review of the literature summarizes the research on several topics. These topics are organized by topic for readability. Current research supports that cognitive abilities and self-efficacy both have an influence on success in the workplace. Research also shows mixed results for the effectiveness of brain training programs. The research sometimes shows cognitive skills increase and transfer to other areas of life and sometimes do not. Research on LearningRx is specifically included to show prior results and the gap in the research. There is currently no research showing the connection between self-efficacy and this program.

Intelligence. General mental ability (GMA), general intellectual ability (GIA), intelligence quotient (IQ), and intelligence are all technical terms used to describe the natural intellectual abilities a person is born with and uses throughout his or her life (Hunt & Madhyastha, 2012; Krumm, Schmidt-Atzert, & Lipnevich, 2014; Newton & McGrew, 2010; Salthouse, 2014; Schmidt & Hunter, 1998). These terms are often used interchangeably, misused, or misunderstood. Intelligence is made up of many skills that work together. For the purposes of this review, the term *general intellectual ability,* or

intelligence, will be defined as a person's natural ability to learn, process information, remember, problem solve, and process both auditory and visual information (Carpenter et al., 2016; Lovden, Backman, Lindenberger, Schafer, & Schmiedek, 2010; Mayer, 2015; Mayer & Skimmyhorn, 2017; Newton & McGrew, 2010; Oh, 2014; Richardson & Norgate, 2015). This is important for learning at a young age, navigating adolescence, becoming an adult, getting a job, and maintaining a career (McDaniel, M., Binder, E., Bugg, J.; 2014)..

When one or more cognitive skills are weak, adults may be able to be successful in all these things, but job functions will be more difficult (Krumm et al., 2014; Lado & Alonso, 2017; Mayer & Skimmyhorn, 2017; Richardson & Norgate, 2015; Schmidt & Hunter, 2004). Weaker cognitive skills cause problems such as not being able to remember names, forgetting tasks, having a hard time following conversations, having poor organization, or being unable to read well (Carpenter et al., 2016; Jedlicka, 2012, 2017). Compensation for lower skills necessitates accommodations in work and life (Anderson, 2011; Gibson et al., 2015; Hunt & Madhyastha, 2012; Jedlicka, 2012, 2017). For example, if a person has low memory skills, he or she may have to keep more notes or create a system that allows for lists, color-coding, and monitoring of tasks. A person can have an IQ standard score that is very high but have one or two low skills that create difficulty in life (Carpenter et al., 2016; Gibson et al., 2015; Jedlicka, 2017). Gaps between subset scores may cause problems because the skills do not work in conjunction with one another to apply to a life skill. One example of this might be a person with a high standard score in processing speed but a low standard score in long-term memory (Astle et al., 2015; Bergman-Nutley & Klingberg, 2014; Carpenter et al., 2016; Jedlicka,

2012, 2017). This gap may cause a person to have difficulty recalling information or have a hard time keeping up with a conversation. These gaps or low subskills may cause difficulty for both children and adults in academic and life settings (Borness, Proudfoot, Crawford, & Valenzuela, 2013; Carpenter et al., 2016; Hill et al., 2016; Kalbe et al., 2018; Mowszowski, Lampit, Walton, & Naismith, 2016).

Intelligence model. Several theories exist regarding the elements that make up intelligence. In this review, the Cattell-Horn-Carrol (CHC) theory provides the structure for how intelligence is defined and applied in life (Carpenter et al., 2016; Gibson et al., 2015; McGrew & Wendling, 2010; Newton & McGrew, 2010). According to CHC, intelligence is based on a three-layer model containing narrow abilities, broad abilities, and overall intelligence (Carpenter et al., 2016; Newton & McGrew, 2010). These are assessed in individuals through a battery of assessments, including fluid reasoning, comprehension-knowledge, visuospatial ability, long-term storage and retrieval, auditory processing, cognitive processing speed, short-term memory, quantitative knowledge, and reasoning. To be effective, designers of brain training programs must acknowledge intelligence has more than one component that must be addressed in the design (Carpenter et al., 2016; Gibson et al., 2015; Ledbetter et al., 2017; Rabipour & Raz, 2012). Effective brain training programs must also combine the CHC theory of intelligence with the concept of neuroplasticity.

Neuroplasticity is the brain's ability to change and grow. It is used in three broad processes: normal development, learning, and recovery from injury (Bherer, 2015; Goghari & Lawlor-Savage, 2017; Goh & Park, 2009; Hill, Zewelanji, & Faison, 2015; Lenn, 1992; Park & Bischof, 2013; Sherman, Mauser, Nuno, & Sherzai, 2017). The

brain's normal development is completed during early adulthood. However, learning can occur throughout a person's life (Goh & Park, 2009; Nordvik et al., 2014; Park & Bischof, 2013). This is the key factor in a person's ability to learn new things and achieve more in life. Procedures or exercises during brain training should be designed to target specific cognitive skills to make them stronger (Birney, 2015; Carpenter et al., 2016; Martin, Clare, Altgassen, Cameron, & Zehnder, 2011; Nordvik et al., 2014; Shah, Weinborn, Verdile, Sohrabi, & Martins, 2017; Styliadis, Kartsidis, Paraskevopoulos, Ionnides, & Bamidis, 2015). The procedures, mental activities, and distractions also use the brain's ability to multitask to strengthen interaction between skills (Gonzalez-Mule, E., & Oh, I.; 2014). This helps people apply the newly obtained skills to their daily lives and transfer them to other activities (Carpenter et al., 2016; Jedlicka, 2012, 2017; Ledbetter et al., 2017).

Validity of intelligence assessments. Researchers have questioned the validity of intelligence assessments. It is important to question the validity of intelligence testing because conclusions drawn from intelligence research may be different if the testing is not valid, therefore impacting correlations between intelliegence and workplace performance. Researchers have questioned the validity of IQ assessments such as the Wechsler Intelligence Scales, Stanford–Binet Intelligence Scale, Woodcock–Johnson Test of Cognitive Abilities, and the Kaufman Tests because they have been normed in North America and Europe (Oh, 2014; Spengler et al., 2015) and therefore may not be generalizable to other countries. If this is the case, then some research may need to be replicated in other countries.

Intelligence is said to be manifested through the ability to learn, reason, and solve problems (Newton & McGrew, 2010; Oh, 2014; Spengler et al., 2015). Intelligence measures have been used in military job placement, hiring, and educational placement for psychoeducational needs in the classroom (Newton & McGrew, 2010; Spengler et al., 2015). These tests cannot be the sole measure for any of these placements because it only provides a limited assessment of a person's abilities. Though cognitive assessments typically include multiple domains, placement and hiring practices should include other measures (Newton & McGrew, 2010; Salthouse, 2014; Spengler et al., 2015).

As people age, they tend to lose some cognitive abilities (Barban et al., 2017; Bherer, 2015; Nordvik et al., 2014; Park & Bischof, 2013; Shah, Weinborn, Verdile, Sohrabi, & Martins, 2017). Children and younger adults naturally have more plasticity; however, adults will probably recognize changes and gains in cognition because they are more able to apply strategies (Park & Bischof, 2013). Park and Bischof (2013) showed evidence of adults' maintaining gains and transfer of skills to life up to 5 years after participating in cognitive training. This lends support to the idea that adult brains can still maintain and improve cognitive skills. If adult brains can maintain or improve cognitive skills, then strategies should be explored to assist with these improvements (Park & Bischof, 2013; Shah, Weinborn, Verdile, Sohrabi, & Martins, 2017).

Brain health. To maintain good brain health, adults need social engagement, mental stimulation, good nutrition, exercise, sleep, and stress management (Barban et al., 2017; Bherer, 2015; Celidoni, Dal Bianco, & Weber, 2017; Muller & Shaikh, 2018; Ngandu, Lehtisalo, Solomon, Kivipelto, & T, 2015; Shakersain, Santoni, Larsson, & Xu, 2015). These factors are interconnected. A person cannot have complete cognitive health

and maintenance of cognitive skills without paying attention to each of them (Xie & Bugg, 2009). Overall brain health is also an important factor in workplace self-efficacy and can be the result of a person's behavior and their engagement with their environment (Nussbaum, 2015). Mental stimulation is important because the brain needs to be exercised just as the body does (Rebok et al., 2013; Rebok et al., 2014; Tennstedt & Unverzagt, 2014). This can take the form of puzzles, games, targeted cognitive training, reasoning training, memory training, and speed training (Barban et al., 2017; Moore, Carpenter, Miller, & Ledbetter, 2019; Ngandu, Lehtisalo, Solomon, Kivipelto, 2015; Xie & Bugg, 2009). These mental activities must be varied, intense, consistent, and challenging to make an impact on a person's daily life (Rebok et al., 2013; Rebok et al., 2014; Tennstedt & Unverzagt, 2014). Adult cognitive skills tend to peak in their mid-20s, so people should begin at an early age to care for their brain health.

Self-efficacy. Self-efficacy is the focus of this research. Self-efficacy is a major component of a person's capability and performance in the work environment (Alessandri et al., 2015; Bandura, 1977; Bandura, 2012; Bates et al., 2013; Lunenburg, 2011). When self-efficacy is low, people's confidence in their abilities is hampered, and this can possibly impede performance, and it can affect both personal and professional lives (Bandura, 2012; Lunenburg, 2011). When professional life is impacted, this can affect the ability to earn income (Alessandri et al., 2015; Hunt & Madhyastha, 2012; Jahan, Tyagi, & Suri, 2015; Keller, 2010; Lunenburg, 2011). Loss of income or not reaching one's potential can impact an individual's personal life. This can become a cycle that is difficult to stop. Difficulty in work life may affect one's personal life and create social-emotional concerns.

Self-efficacy is when people have confidence in their abilities to do things they try (Pajares, 2002). Bandura defined self-efficacy as the confidence people have in their own workplace ability to do things they try. (Bandura, 1977; Bandura, 2012; Sander & Sander, 2003). Bandura argued self-efficacy can only be developed in four ways: mastery experiences, social modeling, social persuasion, and physiological response to stress (Bandura, 1977; Bandura, 2012; Bates, Thompson, & Bates, 2013; Grusec, 1992; Ouweneel, Schaufeli, & LeBlanc, 2013; Ramlall, 2004; Sander & Sander, 2003). These influencers impact a person's behavior in every aspect of life. Self-efficacy reduces or expands discrepancies between personal goals and perceptions of future performance.

Mastery experiences have been shown to help people create successes by overcoming obstacles and exerting effort in an activity or skill (Bandura, 1977; Bandura, 2012; Bates, Thompson, & Bates, 2013; Jedlicka, 2012, Jedlicka, 2017; Ramlall, 2004; Sander & Sander, 2003). This requires a person to give sustained effort. Social modeling can also be called vicarious learning (Bandura, 1977; Bandura, 2012; Bates, Thompson, & Bates, 2013; Ramlall, 2004; Sander & Sander, 2003). This is when a person learns from someone else either directly or indirectly. In the context of brain training, these skills may not be practiced directly, but connected through skills that are similar in nature (Carpenter et al., 2016). Social persuasion is creating a strengthened belief in a person's abilities, often done through positive interaction and feedback (Bandura, 1977; Bandura, 2012; Bates, Thompson, & Bates, 2013; Ramlall, 2004). Feedback, to be effective, should be positive and specific in nature (Carpenter et al., 2016; LearningRx, 2015). If a person only receives unrealistic boasting, they may not believe these statements are true, therefore undermining their belief in themselves (Bandura, 1977; Bandura, 2012; Bates,

Thompson, & Bates, 2013; Jedlicka, 2012, 2017; Sander & Sander, 2003). Physiological response is the body's response to stress or tension and maintaining a positive attitude. Brain training program design should include positive talk, positive feedback, and tasks that challenge clients just beyond their capabilities (Astle, Barnes, Baker, Colclough, & Woolrich, 2015; Gibson, Carpenter, Moore, & Mitchell, 2015; Ouweneel et al., 2013).

This positive orientation toward goals then predicts future job performance and work engagement (Alessandri, Borgogni, Schaufeli, Caprara, & Consiglio, 2015). Organizations must be committed to increasing work motivation and engagement for employees (Ramlall, 2004). This increased commitment by employees assists employers in addressing the rapidly changing demands of modern organizations. When employees have high levels of motivation, they are more willing to exert high levels of effort. Employees must also be willing to invest in themselves, so they can help increase their longevity within an organization (Alessandri et al., 2015; Kim, Oh, Chiaburu, & Brown, 2012).

With increasing demands on both organizations and employees, organizational leaders must consider ways to increase employee loyalty, skills, and performance (Alessandri et al., 2015; Kim, Oh, Chiaburu, & Brown, 2012). By finding ways to increase loyalty, skills, employee satisfaction, and performance of employees, organizations could find additional ways to assist with profitability, lower turnover, engagement, and consistency in the workplace (Ramlall, 2004). As they explore ways to achieve these goals, they may need to use methods that have not been traditionally offered within the workplace. Modeling and mastery experiences are effective strategies

for increasing self-efficacy, which in turn can increase employee satisfaction at work (Alessandri et al., 2015; Bandura, 2017).

Employees must also contribute to their own longevity and performance within an organization. As information evolves, employees must learn and adapt (Ahmed, Hidayat, & Faisal-ur-Rehman, 2015). Positive mood, openness to new experiences, and the ability to adapt are all keys to engagement (Niemiec & Lachowica-Tabaczek, 2015; Woo, Chernyshenko, Stark, & Conz, 2014). Maintaining a positive mood will also reduce the stress employees encounter in high stake situations (Bandura & Locke, 2003; Thompson & Gomez, 2014). This positive attitude also assists with work-family balance (Cicek, Karaboga, & Sehitoglu, 2016). Stressors will not predict tension in an employee. However, the interactions between individuals and their work environments can be affected by these stressors.

Personal characteristics can account for some of these differences in economic and work success when coupled with self-efficacy (Lado & Alonso, 2017; Neal, Yeo, Koy, & Xiao, 2012; Niemiec & Lachowica-Tabaczek, 2015; Tamas, 2010; Woo et al., 2014). Behaviors and environment help to shape the brain to be either healthy or unhealthy (Cicek, Karaboga, & Sehitoglu, 2016; Neal, Yeo, Koy, & Xiao, 2012; Niemiec & Lachowica-Tabaczek, 2015; Woo et al., 2014). If a person is unhappy or has low workplace self-efficacy, the possibility for poor brain health exists. The brain thrives on stimulation and engagement in novel and complex tasks (Bandura & Locke, 2003; Neal, Yeo, Koy, & Xiao, 2012; Niemiec & Lachowica-Tabaczek, 2015; Thompson & Gomez, 2014; Woo et al., 2014).

Self-esteem has also been shown to play a role in learning performance and motivation (Alessandri et al., 2015; Kim, Oh, Chiaburu, & Brown, 2012; Sander & Sander, 2003; Woo et al., 2014). Other factors have also been shown to play a role in core self-evaluations, which are a feature of self-efficacy (Alessandri et al., 2015; Bandura, 2012; Bandura & Locke, 2003; Lado & Alonso, 2017; Woo et al., 2014). These other skills, in addition to self-efficacy, must be considered by organizations for the employee to continue to improve. Locus of control, self-esteem, general intellectual ability, and emotional stability are additional factors within self-efficacy, which in turn influences performance of employees (Alessandri et al., 2015; Kim et al., 2012; Niemiec & Lachowica-Tabaczek, 2015).

This formula of success is not a simple one. Researchers have noted multiple predictors of success, such as self-evaluation, self-efficacy, general mental ability, conscientiousness, and motivation (Alessandri et al., 2015; Kim et al., 2012; Niemiec & Lachowica-Tabaczek, 2015; Ouweneel, Schaufeli, & LeBlanc, 2013; Woo et al., 2014). Some opposition to the belief that self-efficacy aligns with work performance does exist (Krumm et al., 2014; Neal, Yeo, Koy, & Xiao, 2012; Ouweneel et al., 2013). Those who oppose this position generally agree that there is a connection between self-efficacy and engagement but do not support the connection between self-efficacy and performance.

If self-efficacy is a complex theory, then self-efficacy measures should be complex as well. These measures are currently limited because of their complexity and differing opinions about their application (Bates et al., 2013; Burns & Christiansen, 2011; Cherian & Jacob, 2013; Eden, 2003; Sander & Sander, 2003). This research used each participant's own reported improvements to examine this complex topic. Though this

research used Bandura's original definition of self-efficacy, many other definitions support this complexity. Burns and Christiansen (2011) purported self-efficacy beliefs have effects only if a task is attempted, depending on how much effort is put forth, the persistence while facing obstacles, and the ultimate success of the endeavor. This definition is specific to the work environment but could also link to personal life. Personal and professional lives are intertwined, and people often find it difficult to isolate areas of self-efficacy (Burns & Christiansen, 2011; Cherian & Jacob, 2013; Eden, 2003; Sander & Sander, 2003).

Though few studies exist about brain training and self-efficacy, recent studies have begun to identify a connection between the two (Jedlicka, 2012, 2017; Ledbetter, Moore, & Mitchell, 2017; Rabipour & Raz, 2012). A recent study with soldiers who completed a brain training program after experiencing a traumatic brain injury showed evidence of cognitive improvements (Ledbetter, Moore, & Mitchell, 2017). The soldiers in this study showed statistically significant changes in long-term memory, processing speed, auditory processing, and fluid reasoning. These soldiers previously worked with medical professionals to physically heal prior to participating in the ThinkRx brain training program. An additional benefit that was not predicted but was discovered in this study was self-efficacy improvements reported by the soldiers. Soldiers reported increases in self-confidence in both their work lives and their daily lives.

Additionally, Hill, Zewelanji, and Faison (2015) conducted a study with high school students to evaluate their achievement in math, but the researchers discovered improvements beyond cognitive skills. This group of high school students participated in the one-on-one LearningRx training and the LearningRx BrainSkills computer-based

brain training program. The results of this study showed improvements in working memory and long-term memory. Hill, Zewelanji, and Faison (2015) argued the BrainSkills program did not show results as strong as the one-on-one training because the students had to serve as their own motivators. The high school students in this study reported improvements in motivation, enjoyment in math and school, and value in themselves. These new studies show promise for transfer effects in the areas of social-emotional and workplace self-efficacy. Hill also argued that cognitive and attitudinal changes have significant implications for school performance.

Cognitive abilities in the workplace. Researchers should consider cognitive abilities in the workplace because business owners work to build profits for their companies. A business owner must consider who to hire to make the biggest impact on efficiency, productivity, and profits. Hiring is not an easy task; it takes long periods of time to complete and is expensive. Because of this, an employer must consider prior experiences, abilities, personality fit for the position, and how committed a person might be when hired. Cognitive abilities may play an important role when considering a hiring choice. Because this current research focuses on adults, cognitive abilities and the connection to the workplace is important. According to the Bureau of Labor Statistics (2016), 25- to 54-year-old adults make up 81.3% of the civilian labor force, with 77.9% of this population being employed. As only 4.2% of this population is unemployed, adults need to keep their skills sharp to put themselves in a place to return or enter the workforce (U.S. Bureau of Labor Statistics [BLS], 2017).

Cognitive abilities play a role in workplace performance (Krumm et al., 2014; Oh, 2015; Palumbo et al., 2005), though research on the extent of this role has been mixed.

General mental ability (GMA) and general intellectual ability (GIA) are synonymous with IQ (Krumm et al., 2014; Oh, 2015; Palumbo et al., 2005; Schmidt & Hunter, 2004). These terms refer to a person's natural intellectual capabilities to learn, understand, think logically, remember, and process information. General mental ability, or general intellectual ability, has been shown to predict occupational level as well as performance within the job. General intellectual ability is manifested through the ability to learn, reason, and solve problems (Oh, 2015; Palumbo et al., 2005; Schmidt & Hunter, 2004).

The United States Department of Labor rates jobs according to the cognitive abilities needed to perform the job (Hunt & Madhyastha, 2012; USBLS, 2017). General intellectual ability has also been shown to have a direct impact on income earned (Murray, 2002; Spengler et al., 2015). Because low skill jobs require low cognitive abilities and white collar or professional jobs require higher cognitive abilities, the income levels tend to be correlated. The average income earned by a person with an IQ within normal range (90-109) is $46,000, while a person with a higher IQ (120 plus) earns around $68,300 (USBLS, 2017). As the complexity of job performance increases, information processing must increase (Oh, 2014; Richardson & Norgate, 2015; Spengler et al., 2015).

The relationship between employer and employee commitment is symbiotic because expectations, job security, and management all affect job satisfaction and experiences (Kraimer, Seibert, Wayne, Liden, & Bravo, 2011; Nazish, Amjad, Mehboob, & Rizwan, 2013). In turn, the employee's satisfaction and experiences affect the management's expectations and retention of employees. When employees are focused on both their own goals and those of the organization, they are more engaged in their

environment (Creed & Hennessy, 2016). If employees focus on their work goals and have a solid vocational identity, they are willing to reflect on and evaluate their own work.

Even though GIA is considered a good predictor of job performance, some researchers have cautioned against using this as the sole predictor (Krumm et al., 2014; Mayer & Skimmyhorn, 2017; Richardson & Norgate, 2015). Work roles or responsibilities at work are complex in nature. Therefore, the skills required to be considered proficient or effective are complex (Neal, Yeo, Koy, & Xiao, 2012; Schmidt & Hunter, 2004). Neal et al. (2012) proposed nine dimensions of work role performance. These are determined by cross-classifying behavior (proactivity, adaptivity, proficiency) and the levels at which behavior can contribute to performance (team, individual, organizational). These behaviors can be measured in multiple ways, making it difficult to consistently measure them in research (Krumm et al., 2014; Mayer & Skimmyhorn, 2017; Neal, Yeo, Koy, & Xiao, 2012; Richardson & Norgate, 2015).

Levels of performance can also be subjective in nature, adding to their ambiguity. A 40-year follow-up study was conducted on predictors of success, and GIA was found to be a predictor of job performance (Barros, Kausel, Cuardra, & Diaz, 2014; Spengler et al., 2015). Educational attainment, occupational success, and income also provide information to help predict job performance. Additional studies have shown executive attention, along with general mental ability, to be another predictor of success in the workplace (Bosco, Allen, & Singh, 2015). This additional factor also plays a role in the supervisor's ratings of the employee. These considerations are often already included when searching for new employees. This brings into question if GIA should be considered the sole predictor of educational attainment or if educational attainment

happens because of motivation or conscientiousness (Mayer & Skimmyhorn, 2017; Neal, Yeo, Koy, & Xiao, 2012; Richardson & Norgate, 2015).

Measurements of job performance and job satisfaction. When measuring the performance of an employee, supervisors also have a complex job (Alessandri et al., 2015; Bates et al., 2013; Burns & Christiansen, 2011; Mayer & Skimmyhorn, 2017; Neal, Yeo, Koy, & Xiao, 2012; Ramlall, 2004; Richardson & Norgate, 2015). People are motivated to perform because of their supervisors' efforts, and this leads to the desired outcomes (Akomolafe & Ogunmakin, 2014; Alessandri et al., 2015; Kim, Oh, Chiaburu, & Brown, 2012; Ouweneel et al., 2013; Ramchunder & Martins, 2014). In turn, the employees respond depending on their personality traits, motivation, support from superiors, stress, and their levels of workplace self-efficacy. Job satisfaction is critical to organizational success, so employers and supervisors should pay attention to these factors to increase job satisfaction and, in turn, retention and performance. Supervisors who interview candidates for positions often predict candidates' abilities along with their ability to perform the tasks and fit in to an organization. These supervisors are not always correct in their assessments because they will often judge based on extroversion (Kluemper, McLarty, Bishop, & Sen, 2015). The demands on employees can often be difficult to handle, so they must be able to adapt (Jundt, Shoss, & Huang, 2015). This ability to adapt is often difficult to determine in an interview situation.

The Flynn effect may also play a role in job performance, so it must also be considered (Krumm et al., 2014; Mayer & Skimmyhorn, 2017; Oh, 2014; Richardson & Norgate, 2015; Spengler et al., 2015). The Flynn effect indicates that GIA has risen over time. If the Flynn effect is true, people have both higher GIAs and more favorable

supervisory ratings, so this may affect the higher correlations between GIA and workplace performance. Recently, a group of researchers performed a longitudinal study on predictors of occupational success (Spengler et al., 2015). This study examined possible predictors of future adult occupational success, including IQ, socioeconomic status of parents, studiousness as rated by a teacher, and educational attainment.

In the past, IQ was found to be a larger predictor of future success than other factors (Richardson & Norgate, 2015). Richardson and Norgate (2015) found 67% of abilities deemed essential for effective performance were emotional competencies. These mattered twice as much as GIA. These emotional competencies, including stress, self-efficacy, motivation, anxiety, and mental rigor, can impact performance, so they must be considered when determining indicators of job performance (Greenridge, Devonish, & Alleyne, 2014; Mayer & Skimmyhorn, 2017; Oh, 2014; Richardson & Norgate, 2015; Woo et al, 2014).

Cattell-Horn-Carrol theory of cognitive abilities. The Cattell-Horn-Carrol theory of intelligence was explored to create a working definition of intelligence for this review. Intelligence theories offer a broad range of definitions and practical applications to real life (Carpenter et al., 2016; Gibson et al., 2015; Lenn, 1992; McGrew & Wendling, 2010; Newton & McGrew, 2010). The working definition of intelligence in this review will be based on the Cattell-Horn-Carrol theory of intelligence (Carpenter et al., 2016; Gibson et al., 2015; McGrew & Wendling, 2010). The Cattell-Horn-Horn (CHC) theory indicates that intelligence is based on a three layer model containing narrow abilities, broad abilities, and overall intelligence (Gibson et al., 2015; Lenn, 1992; McGrew & Wendling, 2010; Newton & McGrew, 2010). These are assessed in

individuals through a battery of assessments, including fluid reasoning, comprehension-knowledge, visuospatial ability, long-term storage and retrieval, auditory processing, cognitive processing speed, short-term memory, quantitative knowledge, and reasoning. This model is also known as the CHC human ability model. Intelligence has more than one component and each must be addressed during brain training. By combining the CHC model with the concept of neuroplasticity, brain training programs can become more effective (Carpenter et al., 2016; Gibson et al., 2015; Lenn, 1992; McGrew & Wendling, 2010).

Neuroplasticity is the brain's ability to change and grow (Gibson et al., 2015; Lenn, 1992; McGrew & Wendling, 2010; Newton & McGrew, 2010). It is used in three broad processes: normal development, learning, and recovery from injury (Lenn, 1992). The brain's normal development is completed during early adulthood. However, learning can continue to occur throughout a person's life. This is the key factor in a person's ability to learn new things and achieve more in life (Gibson et al., 2015; Lenn, 1992; McGrew & Wendling, 2010; Newton & McGrew, 2010).

Some researchers caution about the use of IQ as a predictor of job performance (Richardson & Norgate, 2015). Richardson and Norgate (2015) purported that job performance has many factors and evaluation criteria and this inconsistency does not allow IQ to be a sole predictor, even claiming that intellectual efficiency is the key to intelligence. Cognitive efficiency occurs when cognitive skills are at or above average, and no significant gaps exist (Gibson et al., 2015; Ledbetter et al., 2017; Lenn, 1992; McGrew & Wendling, 2010; Newton & McGrew, 2010; Richardson & Norgate, 2015). Current researchers have not claimed IQ is the sole predictor, but that it plays a

significant role. Support exists for intelligence as a predictor of both job performance and training proficiency at work (Salthouse, 2014; Schermer, 2013). A person can have a pleasant personality but not the cognitive skill set to perform job requirements. A person can also have the opposite: high cognitive skills without the personality traits to interact with other workers. Intelligence cannot be separated from other factors, including personality traits (Krumm, Schmidt-Atzert, & Lipnevich, 2014; Mayer & Skimmyhorn, 2017; Oh, 2014; Richardson & Norgate, 2015; Woo, et al, 2014).

Brain training. Brain training has many names throughout the cognitive training industry. It is also known as cognitive training, computerized cognitive training, face-to-face brain training, drill-based attention training with strategy instruction, one-on-one cognitive training, one-on-one brain training, cognitive rehabilitation, and metacognitive strategies (Astle, Barnes, Baker, Colclough, & Woolrich, 2015; Bergman-Nutley & Klingberg, 2014; Bigorra, Garolera, Guijarro, & Hervas, 2015; Connor & Shaw, 2014; Dunning & Holmes, 2014; Gibson et al., 2015; Jaeggi et al., 2011; Lebowitz, Dams-O'Connor, & Cantor, 2013; Ledbetter et al., 2017; Rivera-Flores, 2015; Sohlberg et al., 2014; Ward et al., 2017; Yglesias, 2015; Zickefoose, Hux, Brown, & Wulf, 2013). However, these phrases do not always have the same meaning across research and across companies that produce these products or services. For the purposes of this review, brain training will be defined as, "enhancing, rehabilitating, or simply maintaining cognitive function through deliberate cognitive exercises" (Rabipour & Raz, 2012, p. 64). Even though delivery methods and approaches may be different in the brain training industry, the purpose is still the same (Enriquez-Geppert et al., 2013).

No common industry standard has been established for naming conventions, design, or delivery of brain training programs. This creates confusion in the industry and leads to attempts to make comparisons between programs that may or may not be similar. Brain training professionals and researchers agree upon three basic training requirements (Dunning & Holmes, 2014; Enriquez-Geppert, Huster, & Herrmann, 2013; Gibson et al., 2015). First, training should engage more than one cognitive process, so skills can be generalized. Second, training procedures should be varied, so priming effects are avoided. This is when the memory affects the next activity in a short-term manner versus having a long-term effect on the actual skill itself. Training should adapt to each person's abilities. This final piece is important because any brain training program should avoid a one-size-fits-all mentality (Changhong Lu & Tjosvold, 2013; Jaeggi et al., 2011; Ledbetter et al., 2017; Sohlberg, Harn, MacPherson, & Wade, 2014).

Computerized cognitive training is a program delivered individually, using a computer program (Gibson et al., 2015; Jaeggi et al., 2011; Rabipour & Raz, 2012). This delivery can be either adaptive or nonadaptive in nature (Astle et al., 2015; Dunning & Holmes, 2014). Adaptive means the computer changes the skill levels depending on the rate of attainment by the client. Typically, computerized cognitive training is in a game-like format that encourages a client to interact with the computer using progressively more difficult skills (Borness et al., 2013; Jaeggi et al., 2011; Rabipour & Raz, 2012; Span, 2016). Sometimes these programs allow for choice (Rabipour & Raz, 2012). This can be counterproductive because clients can choose procedures and activities they enjoy, not necessarily those they need to increase skills (Astle et al., 2015; Jaeggi et al., 2011;

Span, 2016). Some programs do not give choice but are adaptive in nature and guide the client to do procedures (Dunning & Holmes, 2014).

Computerized brain training has limitations because it lacks a human to control the delivery of training (Rabipour & Raz, 2012; Span, 2016). The client chooses which games or activities are completed. Another limitation of computerized brain training is the number of cognitive skills trained during sessions. When delivering one-on-one training, no matter the program, the trainer can control intensity, mental activities, and the skills trained during a session. The trainer should also help the client set goals at the beginning of the program so there is a shared responsibility to meet those goals (Changhong Lu & Tjosvold, 2013). Some computerized programs are adaptive in nature, but not to the infinite level a trainer can achieve **(**Changhong Lu & Tjosvold, 2013; Hill et al., 2016; Kalbe et al., 2018; Lampit et al., 2014; Rabipour & Raz, 2012; Sohlberg, Harn, MacPherson, & Wade, 2014). The trainer can make the training sessions engaging and use age appropriate interactions, while computer programs use more of a one-size-fits-all format (Jaeggi, Buschkuehl, Jonides, & Shah, 2011; Sohlberg, Harn, MacPherson, & Wade, 2014). Sohlberg, Harn, MacPherson, and Wade (2014) argued computerized training shows promise, but it is hard to automate individualized and dynamic programs that adapt to the needs of the client. This is a necessary component of any direct cognitive intervention because every person is unique.

Other components necessary for computerized brain training games to be effective are the generation of immersive play, repeated engagement, neurocognitive targets, adaptability to challenge the client, and personalization to the client's skills (Mishra, Anguera, & Gazzaley, 2016; Ten Brinke, Best, Crockett, & Liu-Ambrose,

2018). Clients must adhere to repetition in their training on a schedule that allows the neural pressure to create change, and they must be willing for the game to choose the games and levels. In addition to the components necessary for effective brain training games, other factors should be considered in the design of an intervention, such as convenience of game play, device choice for play, competition between friends, and whether the display can be adjusted by the client (Sharar & Meiran, 2015; Ten Brinke, Best, Crockett, & Liu-Ambrose, 2018; Van de Ven et al., 2017). Though these features may not be necessary, the client may consider them to help weigh their options.

Face-to-face brain training can be delivered in either one-on-one or group formats. One-on-one brain training is an individually administered program designed to be interactive between the trainer and client (Carpenter et al., 2016; Dunning & Holmes, 2014; Gibson et al., 2015; Jedlicka, 2012, 2017; Ledbetter et al., 2017; Yglesias, 2015). This format allows for human coaching and interaction to occur during each session. Individualized, in-person training ensures the weakest skills are targeted for each training session. One-on-one training allows the trainer to choose the procedures the client completes, the length of time spent on each procedure, and the levels of each procedure. The trainer is in control of the content delivery sequence for the clients.

Brain trainers can also provide positive feedback and support to the client so they do not get frustrated (Dunning & Holmes, 2014; Gibson et al., 2015; Jedlicka, 2012, 2017; Ledbetter et al., 2017; Yglesias, 2015). By giving positive feedback immediately, the trainer engages the client more continuously, in contrast to waiting for the end of an entire training set, as is required by most computerized programs (Moore, A, Carpenter, D, 2019). This contributes to the increase in positive self-efficacy for the client (Jedlicka,

2012, 2017**)**. Trainers can adjust the intensity and add mental activites so the client strengthens their brain in multiple ways (Rebok et al., 2013; Rebok et al., 2014). The more cognitive skills that are engaged during the session, the more generalized the abilities become (Carpenter et al., 2016; Dunning & Holmes, 2014; Gibson et al., 2015; Jedlicka, 2012, 2017; Ledbetter et al., 2017; Yglesias, 2015). Another aspect of one-on-one training that separates it from a computerized training is the ability for the trainer to apply gains in skill to real life. This ensures the client pays attention to the transfers that occur (Bigorra, Garolera, Guijarro, & Hervas, 2015; Jaeggi et al., 2011; Jedlicka, 2012, 2017; Sander & Sander, 2003). Depending on the program, some one-on-one training programs allow a trainer to have choice and control the adaptability for the client's skill set. Group brain training is delivered in the same way as one-on-one brain training (Dunning & Holmes, 2014; Rabipour & Raz, 2012).

People are generally optimistic about the possibilities of brain training, though they may have mixed feelings about the duration and frequency of training (Schubert, Strobach, & Karbach, 2014). Strategy-based approaches have been compared to cognitive training, but they are two completely different approaches. Strategy-based approaches train task-specific procedures and employ accommodations that improve given tasks without transfer to other tasks (Connor & Shaw, 2014; Dunning & Holmes, 2014; Folkerts, Roheger, Franklin, Middelstadt, & Kalbe, 2017; Jaeggi, Buschkuehl, Jonides, & Perrig, 2008; Ward et al., 2017). This approach is often used within school or workplace settings for content-based instructional practice or for teaching workplace knowledge. Conversely, brain training targets specific cognitive skills and strengthens them with the goal of broad transfer into life or work (Folkerts, Roheger, Franklin, Middelstadt, &

Kalbe, 2017; Jaeggi, Buschkuehl, Jonides, & Perrig, 2008; Ward et al., 2017). These cognitive skills include attention, working memory, logic and reasoning, long-term memory, auditory processing, visual processing, and executive function.These intraindividual measures allow researchers to examine implications for application of brain training for specific groups, such as students with learning disabilities, elderly adults, working adults, or individuals with mental impairments (Blacker, Negoita, Ewen, & Courtney, 2017; Folkerts, Roheger, Franklin, Middelstadt, & Kalbe, 2017; Hill et al., 2015; Konen & Karbach, 2015; Noack, Lovden, & Schniedek, 2014).

Due to methodological considerations, scholars have had mixed opinions of the transfer of cognitive changes to broad tasks in life and work (Folkerts, Roheger, Franklin, Middelstadt, & Kalbe, 2017; Noack, Lovden, & Schniedek, 2014). Two types of transfer are defined in this review: near and far. Near transfer is defined as untrained task improvement, specific to a cognitive skill, also known as task-specific improvement (Blacker, Negoita, Ewen, & Courtney, 2017; Folkerts, Roheger, Franklin, Middelstadt, & Kalbe, 2017; Noack, Lovden, & Schniedek, 2014). Far transfer, on the other hand, is improvement in untrained skills in real life (Blacker, Negoita, Ewen, & Courtney, 2017; Hill et al., 2015; Lampit et al., 2014; Noack et al., 2014). These skills are not directly connected to activities, games, or procedures practiced during brain training. Intraindividual measures of transfer show promise for measurement because individuals have their own baselines from which to measure growth (Blacker, Negoita, Ewen, & Courtney, 2017; Folkerts, Roheger, Franklin, Middelstadt, & Kalbe, 2017; Hill et al., 2015; Konen & Karbach, 2015; Noack, Lovden, & Schniedek, 2014).

Though there are mixed views on whether brain training improves daily performance, shows improved performance on the training tasks, or improves performance on transfer tasks, the research is continuing to develop (Jedlicka, 2012, 2017; Konen & Karbach, 2015; Noack, Lovden, & Schniedek, 2014; Simons et al., 2016). Transfer will be further explored throughout the brain training section of this review as it pertains to particular groups or interventions.

Brain training with children. Childhood brain training has rapidly grown and continues to be explored in research. It is important to explore this topic for the current review so a pattern of cognitive improvements and qualitative life improvements can be established across many populations. If cognitive change and growth with children is possible, one can assume these same changes are possible in adults. Some authors have suggested it is not a question of if cognitive training works, but of which approach works best (Birney, 2015; Hill et al., 2015; Jaeggi et al., 2011). Computerized brain training is used to engage in specific activities that aim to enhance cognitive skills because of repetition over a specified period of time (Jaeggi, Buschkuehl, Jonides, & Perrig, 2008; Rabipour & Raz, 2012). Most research found for this review had one to three areas of focus for cognitive training, such as working memory, executive function, or processing speed, no matter the methodology used (Astle, Barnes, Baker, Colclough, & Woolrich, 2015; Bergman-Nutley & Klingberg, 2014; Bigorra, Garolera, Guijarro, & Hervas, 2015; Connor & Shaw, 2014; Dunning & Holmes, 2014; Gibson et al., 2015; Jaeggi et al., 2011; Lebowitz, Dams-O'Connor, & Cantor, 2013; Ledbetter et al., 2017; Rivera-Flores, 2015; Sohlberg et al., 2014; Ward et al., 2017; Yglesias, 2015; Zickefoose, Hux, Brown, & Wulf, 2013).

Though school-based interventions have shown improvements for children with disabilities, they cannot improve all areas of life because school-based interventions do not change cognitive abilities (Bigorra, Garolera, Guijarro, & Hervas, 2015; Rivera-Flores, 2015; Serpell & Esposito, 2016). Educational interventions, when implemented by themselves, do not capitalize on neuroplasticity, and therefore cannot facilitate cognitive changes (Rivera-Flores, 2015). These prescribed structured activities, such as illustrated cards that are used to increase inductive reasoning, have been shown to increase those specific skills (Reyes & Amarnani, 2015). These structured activities show specific improvements, but no transferability into other skills. Even strategies such as positive self-talk have been shown to reduce impulsive behaviors, but these strategies do not change the behaviors' root causes (Astle, Barnes, Baker, Colclough, & Woolrich, 2015; Bigorra, Garolera, Guijarro, & Hervas, 2015; Jaeggi et al., 2011; Rivera-Flores, 2015; Serpell & Esposito, 2016; Sohlberg et al., 2014). The permanency of transfer has not been explored.

Computerized training should be considered a viable intervention because of its ease of implementation (Astle, Barnes, Baker, Colclough, & Woolrich, 2015; Rivera-Flores, 2015). Children can train on a computer in any setting and might enjoy the training because most children have experienced it previously (Astle et al., 2015). Adaptive computerized programs have shown significant improvements over nonadaptive ones in working memory and attention symptoms in groups up to the age of 16 (Astle, Barnes, Baker, Colclough, & Woolrich, 2015; Bergman-Nutley & Klingberg, 2014; Bigorra, Garolera, Guijarro, & Hervas, 2015; Jaeggi et al., 2011; Rivera-Flores, 2015; Sohlberg et al., 2014). Bigorra et al. (2015) showed long-term transfer of these attention

skills after the completion of adaptive training. These studies show promise, but in computerized programs, it is difficult to automate the adaptive nature needed to meet the skill progression of students (Astle et al., 2015; Bergman-Nutley & Klingberg, 2014; Bigorra et al., 2015; Sohlberg et al., 2014). Interestingly, a comparison between one-on-one brain training and a combination approach of one-on-one with computerized training showed gains in GIA with only a long-term memory discrepancy between the two approaches (Moore, Carpenter, Miller, & Ledbetter, in press; Schmiedek et al., 2014). Some researchers have been bold enough to make definitive statements about cognitive training, saying dynamic programs are necessary when delivering cognitive interventions. These statements suggest the basis for this type of intervention needs to be explored. Another author stated researchers should not question if cognitive training works, but which approach works best for which audience (Jaeggi et al., 2011).

Brain training with adults. Brain training is important for adults both during their working years and as they reach advanced age. These two adult groups have different needs in the areas of cognitive improvement and transfer of skills to real life. The results of adult brain training studies in both age groups are mixed for both cognitive improvement and transfer effects (Ballesteros et al., 2014; Ballesteros et al., 2015; Ballesteros et al., 2017; Kalbe et al., 2018; Nouchi et al., 2013; Oei & Patterson, 2013; Strenziok et al., 2014; Ten Brinke et al., 2018). Many studies have been completed on computerized training, one-to-one training, and mixed approaches, but the results are inconsistent, especially regarding transfer effects. Computerized brain training is the most common form of delivery for adults. Some of the studies even included the use of games that were not originally designed as cognitive training games, such as Space Fortress,

Rise of Nations, Mario 64, and Tetris (Ballesteros et al., 2014; Ballesteros et al., 2015; Ballesteros et al., 2017; Nouchi et al., 2013; Oei & Patterson, 2013; Strenziok et al., 2014; West et al., 2017). One-on-one delivery includes approaches such as Double N-Back practice, specific skills practice, LearningRx, and positive self-talk (Carpenter et al., 2016; Dunning & Holmes, 2014; Gibson et al., 2015; Jedlicka, 2012, 2017; Ledbetter et al., 2017; Yglesias, 2015). Another concern for both adults and children is the ability for a brain training program to produce long-term, lasting results.

When trainers use games that were not originally designed as brain training games, the results showed no significant changes in visual processing and processing speed but did show some strengthening of learning and retrieval (Strenziok et al., 2014; Voss et al., 2012). These interventions may not have shown significant changes but lay a good foundation for the exploration of neuroplasticity (Bozoki, Radovanovic, Winn, Heeter, & Anthony, 2013). Further, when participants were allowed to choose activities, levels, and games, the cognitive changes were disappointing. Some near transfer effects, or transfer to similar skills, were observed with adults who participated in brain training with the use of games (Ballesteros et al., 2014; Ballesteros et al., 2015; Ballesteros et al., 2017; Dunning & Holmes, 2014; Nouchi et al., 2013; Oei & Patterson, 2013; Schmiedek et al., 2014; Strenziok et al., 2014; West et al., 2017). When choosing a program to administer brain training to older adults, trainers should consider things such as dexterity, vision, hearing, and the ability or willingness to use a computer. Often, an older adult is not able to manipulate a mouse. Therefore, one cannot judge if the true concern is processing speed or simply dexterity (Ballesteros et al., 2014; Ballesteros et al., 2015; Ballesteros et al., 2017; Nouchi et al., 2013; Oei & Patterson, 2013; Strenziok et al.,

2014; West et al., 2017). If an older adult has not been exposed to computers, then they may be resistant to the use of computers. Adults may also feel some programs are too childlike to connect to and may disconnect from the games because of this. Directly after training and 2 years after training, both reasoning and episodic memory showed significant improvements. These sessions were delivered in 1-hour blocks over the course of 100 days. This shows the impact that intensive and more comprehensive training can have an impact on both ability and broad transfer. A final study had three groups work through an adaptive comprehensive training program over a 16-week period (Ward et al., 2017).

Traumatic brain injury (TBI) affects the brain in areas such as memory and processing speed (Ledbetter, Moore, & Mitchell, 2017; Zickefoose, Hux, Brown, & Wulf, 2013). When brain trainers deal with TBI, clients often complain about memory loss, attention concerns, and processing speed (Ledbetter et al., 2017; Moore & Ledbetter, 2017; Moore, Ledbetter, & Carpenter, 2017). Attention concerns can be shown through magnetic resonance imaging (MRI) and the default mode network in the brain (Ledbetter et al., 2017). The network is disorganized with much activity, even in a resting state. After a mixed methods case study of clients who did both life and training interventions, clients reported improvements in problem solving, focus, and life motivation, while MRIs showed a reorganization of the default mode network.

Lumosity and attention process training, when combined, only showed limited generalization while also presenting practice effect concerns (Zickefoose et al., 2013). Another concern in the literature on adult brain training is short training sessions and short duration of programs (Astle et al., 2015; Bergman-Nutley & Klingberg, 2014;

Bigorra et al., 2015; Connor & Shaw, 2014; Ledbetter et al., 2017; Rivera-Flores, 2015; Sohlberg et al., 2014; Ward et al., 2017; Yglesias, 2015; Zickefoose, Hux, Brown, & Wulf, 2013). Multiple training regimens only required four to eight weeks of training with only 10 to 30 minutes of training at a time. When combined with a lack of trainer or coach, this prevents a participant from training with intensity. Intensity of the training affects both the significance of cognitive improvement and the transfer effects (Dunning & Holmes, 2014; Gibson et al., 2015; Jaeggi et al., 2011; Lebowitz, Dams-O'Connor, & Cantor, 2013). Additionally, without a trainer present, the adults cannot participate in added mental activities while they do brain training activities (Ballesteros et al., 2014; Ballesteros et al., 2015; Ballesteros et al., 2017; Nouchi et al., 2013; Oei & Patterson, 2013; Strenziok et al., 2014; West et al., 2017).

When focused on a singular skill using one-to-one brain training, such as working memory, dramatic improvements in fluid intelligence can occur (Dunning & Holmes, 2014; Jaeggi, Buschkuehl, Jonides, & Perrig, 2008). The transfer effects are not supported when nonadaptive training, short duration of sessions, or short duration of training program are present (Ballesteros et al., 2014; Ballesteros et al., 2015; Ballesteros et al., 2017; Nouchi et al., 2013; Oei & Patterson, 2013; Strenziok et al., 2014; West et al., 2017). With an increase in session length, increased duration of the total program, and addition of supervision, participants began to see more significant gains in cognitive skills (Connor & Shaw, 2014). Only one study showed computerized training results were as good as one-to-one training after TBI. Even after a TBI, the brain retains its plasticity, so cognitive change is still possible. Within 40 hours of training, minor cognitive dysfunctions began to show improvement. In one study, younger adults showed

improvements in some skills after training, even without longer training sessions (Nouchi et al., 2013). These young adults did not show improvements in attention, fluid intelligence, short-term memory, or reading ability. These data support the notion of longer training programs.

Cognitive decline begins around 30 years of age (Li et al., 2008; Rhodes & Katz, 2017). As adults age, they often report concerns such as decreased memory, decreased attention, lack of awareness, reasoning, psychomotor speed, and executive function deficits (Burki et al., 2014; Corbett et al., 2015; Edwards, Fausto, Tetlow, & Corona, 2018; Haesner et al., 2015; Li et al., 2008; Van de Ven et al., 2017; West et al., 2017). These adults also reported wanting to participate in active ageing measures so they could increase or maintain their cognitive skills (Burki et al., 2014; Pickersgill, Broer, Cunningham-Burley, & Deary, 2017). Active ageing is the "process of optimizing opportunities for health, participation, and security to enhance quality of life as people age" (Pickersgill et al., 2017, p. 93). Adults may not have as much plasticity as children or as much capacity to improve on tasks, but cognitive improvement can occur (Li et al., 2008) . Significant benefits have been shown in areas such as memory, reasoning, executive function, attention, and psychomotor speed in randomized control studies after training for longer periods of time (Corbett et al., 2015; Edwards, Fausto, Tetlow, & Corona, 2018; Van de Ven et al., 2017; West et al., 2017). Performance limits were reached much sooner for older adults than for young children (Ballesteros et al., 2014; Ballesteros et al., 2015; Ballesteros et al., 2017; Burki et al., 2014; Folkerts et al., 2017). Qualitative improvements such as remembering to remember, brain engagement, quality of life, wellbeing, and cognitive processing efficiency were also reported. Far transfer

effects are questionable after 4 weeks and 3 month follow-up testing; however, some near transfer skills were sustained over a 10 year period (Ballesteros et al., 2014; Ballesteros et al., 2015; Ballesteros et al., 2017; Edwards, Fausto, Tetlow, & Corona, 2018; Li et al., 2008; Van de Ven et al., 2017).

LearningRx brain training. The LearningRx program is the core intervention method in this research, so exploring both the effectiveness and the transfer qualities of this program are important. Therefore, research specific to this program was sought as support for improvements in both cognition and life applications. This program is unique in its approach and evaluation of both cognitive and life changes for each client (Carpenter et al., 2016; Gibson, 2007; Gibson et al., 2015; Ledbetter et al., 2017). Many brain training programs only measure progress based on activity and levels accomplished (Simons et al., 2016). This training program was based on the Cattell-Horn-Carrol theory of intelligence and can be delivered to clients age 4 and up (Gibson, 2007; Gibson et al., 2015). The LearningRx learning model (see Figure 1) shows how cognitive skills can affect academic performance (Gibson, 2007). This model is the basis for the LearningRx programs.

Researchers have found improvements in both cognitive areas and real life, including significant improvement results with children between the ages of 8 and 14 in general intellectual ability (GIA) and logic (Carpenter et al., 2016; Gibson, Carpenter, Moore, & Mitchell, 2015). Even in shorter than normally prescribed programs, improvements in processing speed and working memory have been seen in 8- to 14-year-old children. By improving a child's overall GIA, one would expect transfer into real life in areas such as school improvement and behaviors (Carpenter et al., 2016; Gibson,

Carpenter, Moore, & Mitchell, 2015; Hill, Zewelanji, & Faison, 2015; Jedlicka, 2012, 2017). Significant improvements have been shown in academic settings among children who have completed LearningRx programs versus those who have not. These academic gains do not appear to be affected by age or the type of LearningRx program (Carpenter et al., 2016; Gibson, Carpenter, Moore, & Mitchell, 2015; Jedlicka, 2012, 2017; Luckey, 2009; Pfister, 2012).. Again, these transfer effects are important because cognitive improvement is important. However, transfer to real life should be the ultimate goal because improvement without real life transfer does not change lives.

The more comprehensive the brain training program, the more significant the results and signs of transfer (Carpenter et al., 2016; Gibson, Carpenter, Moore, & Mitchell, 2015; Schmiedek et al., 2014). Directly after training and 2 years after training, both reasoning and episodic memory showed significant improvements. These sessions were delivered in 1-hour blocks over the course of 100 days. This shows the effect that intensive and more comprehensive training can have on both ability and broad transfer. A final study had three groups work through an adaptive comprehensive training program over a 16-week period (Ward et al., 2017). Though improvements were shown in executive function, working memory, episodic memory, and fluid intelligence, the study showed the need for methods to help in transfer. This could be because adults have solidified habits learned with lower cognitive skills over a lifetime. Younger children do not yet have these habits as a part of their lives, so transfer can occur more easily. As in aerobic activity, brain training should provide discomfort to make change, while giving the client enjoyment and engagement (Pickersgill et al., 2017).

Methodologies Previously Used

Methodologies previously used to study this topic included both qualitative and quantitative methodology. The majority of the studies conducted prior to this one were quantitative in nature. General mental ability was measured, as were subscores in processing speed, auditory processing, and others in several studies (Edwards, Fausto, Tetlow, & Corona, 2018; Van de Ven et al., 2017). Some researchers did measure both qualitative and quantitative transfer effects (Carpenter et al., 2016; Gibson, Carpenter, Moore, & Mitchell, 2015; Schmiedek et al., 2014; Ward et al., 2017). Few studies showed the differences using the LearningRx program in both life and cognitive skills; therefore, researchers used a mixed method approach (Carpenter et al., 2016; Gibson, 2007; Gibson et al., 2015; Ledbetter et al., 2017).

Instruments/Data Sources Previously Used

The majority of studies found during this review of the literature engaged in the use of quantitative data sources such as cognitive skills scores (Carpenter et al., 2016; Dunning & Holmes, 2014; Gibson, Carpenter, Moore, & Mitchell, 2015; Jaeggi, Buschkuehl, Jonides, & Perrig, 2008). These cognitive skills scores are important because the focus of these studies was to measure improvements in those areas. Some observation tools and surveys were used in other studies (Ballesteros et al., 2014; Ballesteros et al., 2015; Ballesteros et al., 2017; Jedlicka, E. 2012). No research was found that used the same methodology and data sources as this current research. One artifact review was found that focused on the improvements of soldiers who suffered from a traumatic brain injury (TBI; Ledbetter, Moore, & Mitchell, 2017). This study was

a retrospective artifact review like this current study. However, no studies found combined both artifact collection and review with two interviews.

Summary

The research on cognitive training is as varied as the methodologies used. Cognitive training shows promise in singular areas, while the body of evidence suggests training across cognitive areas, one-on-one, with adaptive procedures is an effective approach (Carpenter et al., 2016; Gibson et al., 2015). Both cognitive abilities and self-efficacy have an impact on the workplace and performance of employees (Ahmed et al., 2015; Cherian & Jacob, 2013; Gottfredson, 1997; Richardson & Norgate, 2015). Employers must constantly explore ways to both motivate employees and increase performance. Increased performance and self-efficacy have been shown to increase longevity of employees. Bandura's self-efficacy theory suggests when people can believe in their own capabilities they are able to succeed at higher rates (Bandura, 1977; Bandura, 2012). When employers increase longevity, they have fewer hiring and training costs for their businesses.

The causal model of cognitive ability and job performance indicates that people perform at higher rates when they have higher cognitive abilities (Gottfredson, 1997; Schmidt, Hunter, & Outerbridge, 1986). This model also shows that people who have higher cognitive abilities choose to perform jobs that require higher ability levels. The Cattell-Horn-Carroll theory of intelligence indicates that many cognitive skills are used in the brain and come together to create the notion of intelligence (Flanagan & Dixon, 2014; Hoelzle, 2008; Schneider & McGrew, 2012).. The LearningRx program is built on this theory and uses the brain's natural neuroplasticity to make changes and improvements in

a person's intelligence and, in turn, life (Stiles, 2000). These theories inform the research questions by providing a foundation that connects the basic premise of the LearningRx training model to self-efficacy and work performance.

The design of the proposed research is based first on the design of the LearningRx program (LearningRx, 2015). The program already includes a pretraining, semistructured intake interview and a postprogram, semistructured exit interview. During the program, both the trainers and program director collect session training notes about improvements and minigoals. Because this program includes interviews with all clients, it offers an opportunity for the researcher to collect qualitative data about how each client feels before, during, and after a program and the changes they may experience. This could provide insight into what self-efficacy changes may have occurred. The researcher also conducted a structured follow-up interview specifically asking questions addressing self-efficacy. The research collected in the literature review shows many types of cognitive training that have positive effects on cognitive skills. However, none of the studies focused on more than two to three cognitive skills during training. However, the LearningRx program covers multiple cognitive skills through a one-on-one targeted skills approach that is dynamic in nature.

Chapter 3 will describe the research methodology, research design, sources of data, sample selection, collection process, and analysis of the data. In this chapter, the researcher will also present the ethical considerations, along with the limitations and delimitations of the research.

Chapter 3: Methodology

Introduction

The purpose of this qualitative descriptive case study was to explore the self-efficacy of adults who completed a ThinkRx brain training program at LearningRx centers. This study was needed to provide possible interventions or programs to help employees increase their self-efficacy in the workplace. Employers and employees can each use this intervention to increase productivity and performance for the employee. The target population for this research was the adult population who completed a LearningRx program between the years 2016 and 2018 in [redacted].

The research was conducted by collecting existing artifacts from the [redacted] LearningRx center and conducting interviews. These artifact data are self-reported statements from each client about concerns, problems, and improvements. Other data were obtained through participant interviews and member checking interviews. Businesses are always concerned with employee performance and constantly explore ways to improve this so profits improve. Employees want to keep their positions and many want to advance in companies.

Self-efficacy is a key component in employee performance and is not yet explored in connection to brain training. In this research, self-efficacy was generally defined as a person's belief in his or her own ability, specifically regarding work performance (Bandura, 1977, 2006, 2008, 2012). This chapter will focus on the methodology used, design of the study, sources of data, collection and analysis of the data collected, and limitations of the study. This chapter will examine each of these areas in detail.

Statement of the Problem

It was not known if adults who graduate from a ThinkRx in-person one-on-one brain training program perceive self-efficacy improvements in their lives. Self-efficacy leads to higher performance in the workplace, as do higher cognitive skills. However, it was not known if or how employees can gain promotions if they are able to gain higher levels of self-efficacy. Gaining higher levels of cognitive skills might affect their self-efficacy in the workplace, therefore helping them to increase their confidence in their own abilities. The problem affecting both organizations and employees is low self-efficacy and lower performance.

Giving employees an option to increase cognitive skills and, in turn, self-efficacy, may increase their productivity. Employees may also choose to increase their skills to advance in the workplace. The general population affected by poor self-efficacy are adults with low cognitive abilities and adults who want to improve work performance. This study was also designed to give organizations options for professional improvement of their employees as a way to increase performance and productivity. This study contributes by providing an option for adults to change their impressions about their workplace self-efficacy.

Research Question

The research question relates to the problem because it specifically focuses on themes that are self-reported by adults who have completed a ThinkRx one-on-one brain training program. By examining the perceptions, this researcher was able to discover if self-efficacy was a common theme among adult clients.

The phenomenon studied was self-efficacy. Self-efficacy was defined by Bandura as a person's belief in his or her own abilities, specifically in work performance (Bandura, 1977, 2006, 2008, 2012). This study was an examination of self-efficacy in the participants' lives. The following research question served as a guide in this qualitative study:

RQ_1: How do adults who completed a ThinkRx brain training program perceive their workplace self-efficacy?

The data used for this study were collected from a brain training center in [redacted]. These data include three items: (a) archive data from the brain training center, (b) a researcher-lead interview, and (c) member checking interview. These archived data were artifacts from the [redacted] brain training center and included postprogram exit notes. All of these data were used to answer research questions. This question is appropriate for qualitative methodology because it is open-ended and broad to assess the perceptions of adults who trained in a ThinkRx brain training program. The question focuses on perceptions of self-efficacy and workplace concerns after the completion of a brain training program.

Research Methodology

The methodology chosen for this study was qualitative. This qualitative case study's intent was to reveal personal perceptions participants have of self-efficacy and workplace concerns and improvements. Qualitative methodology is exploratory research that uses documents, artifacts, or interviews to discover trends and themes within a phenomenon (Babbie, 2013; Frost, 2013; Stake, 1995, 2005, 2006; Yin, 1981, 2011, 2018). This method is used to explore the perceptions of people, cultures, or particular

cases. The focus of quantitative research is to generalize, predict, or give causal explanations, while the focus of qualitative research is to build context, interpret, and understand perspective (Kuckartz, 2014; Lichtman, 2006; Nebojša, 2015). Qualitative research is subjective in nature and examines life experiences (Robinson, O., 2014). When a researcher searches for patterns in data instead of analyzing existing quantitative data, qualitative research is appropriate. The purpose of the study was not to generalize the results but to explore the phenomenon of self-efficacy within the work environment.

A qualitative approach was chosen for this study for several reasons. First, this methodology was chosen based on the research question. Next, artifacts in the form of program notes were collected from a brain training center. These data included notes discussing both social-emotional and workplace concerns and improvements reported by each adult, specifically asking questions about self-efficacy. The artifacts were the postprogram notes. These data are the participants' stories because they self-reported concerns and changes perceived after one-on-one brain training. (Hughes, 2006). These notes were collected in real time, not as a reflective tool. Second, face-to-face interviews occured, including questions specifically about social-emotional and workplace self-efficacy (Yin, 1981, 2011, 2018). The research question allowed for in-depth interviews, which were useful in obtaining information about the participants' perceptions of their experiences of the brain training program (Stake, 1995, 2005, 2006; Yin, 1981, 2011, 2018). These interviews were inductive in nature, while quantitative research is more deductive because conclusions are drawn after data are collected. Finally, this researcher conducted member checking interviews to ensure the participants' stories were accurately represented (Koelsch, 2013). Follow up questions were asked of participants during the

member checking interviews. Using the participants' own stories and perceptions of their own improvements allowed me to begin with specific instances and move to general conclusions (Abeyasekera, 2005; Park & Park, 2016). These self-reported markers were collected in real time, rather than being reflective data. This contributed to the accuracy of the information provided by each participant.

Alternative methodologies were explored for this study, including quantitative and mixed methods (Babbie, 2013; Hughes, 2006). Quantitative research was ruled out because of time constraints and the lack of a control group, as well as its inability to answer the research question. It was also ruled out because the data collected in this study were not numeric, but narrative in nature. These narrative interviews were appropriate to a qualitative study. The focus of this research was not predictive, but descriptive in nature.

Quantitative methodology does not support the discovery of perceptions, thoughts, and opinions of each participant, and therefore would not provide answers to the research question (Stake, 1995, 2005, 2006; Yin, 1981, 2011, 2018). The group for this study was small, and a quantitative study often requires large numbers of participants (Stake, 1995, 2005, 2006; Yin, 1981, 2011, 2018). Questions for this large group are often closed-ended, while the questions for a small group allow for open-ended questions with deeper exploration of themes. Open-ended questions give the participants the opportunity to be self-reflective in their answers (Yin, 1981, 2011, 2018).

Conducting a mixed methods study would require following a participant during an entire brain training program, reading multiple documents, conducting multiple interviews or observations, and using assessment data. This would be a long process that

lasts over several months. This is not possible because participants may take different lengths of time to complete a program and train throughout the day. This would be a time and financial burden, so it was not possible. It might, however, be a consideration for future research. Additionally, the impact of LearningRx training could be observed for immediate, long-term, and transfer effects.

To summarize, the rationale for a qualitative case study are as follows: (a) the research question is open-ended and begins with "what"; (b) the topic should be explored; (c) interviews will allow for details to be expressed by each participant (Stake, 1995, 2005, 2006; Yin, 1981, 2011, 2018). The data collected for this study were: (a) program notes; (b) researcher conducted interviews; (c) member checking interviews (Stake, 1995, 2005, 2006; Yin, 1981, 2011, 2018). The interview transcripts included direct quotes from participants showing perceptions of self-efficacy and workplace concerns and improvements after their brain training programs.

Research Design

This study was a single case descriptive case study design using three pieces of data: exit notes, a researcher structured follow-up interview, and member checking interview (Frost, 2013; Park & Park, 2016). Descriptive case study involves beginning with a phenomenon, defining the case, and defining the unit of analysis (Yin, 1981, 2011, 2018). The exit notes were collected from participants by the brain training center. These same artifacts are kept for each participant and are based on participants' perceptions about their own improvements at the completion of the program. General demographic information was also collected from the [redacted] for this population for statistical use. Because these personal accounts are based on a common experience of the

participants, a descriptive case study design was appropriate (Stake, 1995, 2005, 2006; Yin, 1981, 2011, 2018). This single case involved a group of adults over the age of 18 who had completed a ThinkRx brain training program since 2015.

The researcher conducted individual interviews for each participant, interviewing until a saturation of data was collected. Because this researcher has personal experience with this program, the interviews conducted with participants were more similar to a conversation than to an interview (Stake, 1995, 2005, 2006; Yin, 1981, 2011, 2018). This personal connection helped the participants feel comfortable sharing their perceptions in an honest manner. For the third piece of data, this researcher conducted follow-up member checking interviews and asked for clarification on the interpretation of perceptions (Koelsch, 2013). These questions allowed the researcher to ask clarifying questions about social-emotional self-efficacy and workplace self-efficacy improvements, if any had occurred.

In this single-case case study design, the unit of analysis was one group of adults over the age of 18 who completed an entire ThinkRx brain training program. The unit of observation was each adult individual. Names and all data from study subjects were collected with support from the [redacted] of Cognitive Research in Colorado Springs, Colorado on adults who completed LearningRx brain training programs between 2016 and 2018. Assistance was also provided by the Director of the [redacted] brain training center. A group of 10-15 adult clients were purposefully chosen by the [redacted] for this case study based on the richness of artifact available. The [redacted] LearningRx center was chosen as the primary data source because of proximity and richness of the data available for research. The [redacted] named this

center as a research site. Because this group already completed a LearningRx program, a control group was not possible; therefore, an experimental design was not possible.

Alternatives also considered in this study were action research, causal design, and experimental design (Beach & Brun Pedersen, 2016; Coghlan & Brydon-Miller, 2014; Kirk, 2013). Action research allows the researcher to take an active role with each participant (Coghlan & Brydon-Miller, 2014). This would not be appropriate because the LearningRx trainer must follow a prescribed program. Causal design was ruled out because the purpose of this study was not to find cause and effect (Beach & Brun Pedersen, 2016). Experimental design was not chosen because the researcher had no control over the participants in the study and did not consider cause and effect, and the artificial nature of this design could alter the reports of participants (Kirk, 2013).

Population and Sample Selection

This researcher collected two kinds of data: one from participants and one from artifacts (expost facto data). The population of the study will first be described, followed by discussion of the sampling strategy and size for both methods of data collection. Purposeful sampling was used for all data sources.

Population. A population is a complete set of people that have specified characteristics in common (Stake, 1995, 2005, 2006; Yin, 1981, 2011, 2018). The target population, as defined for this study, was all people who have completed a ThinkRx program and are over the age of 18 (LearningRx, 2015). Most adults who participate in this program are from middle and upper income populations because of the investment costs associated with the program. LearningRx centers are located across the United States in over 50 cities. This study focused on participants from the [redacted]

brain training center. The Northern Colorado LearningRx center has been identified as a research center by the Gibson Institute of Cognitive Research.

Participant sample. All participants were chosen using purposeful sampling. Purposeful sampling is choosing participants based on qualities they possess (Etikan, Musa, & Alkassim, 2016; Gentles, Charles, Ploeg, & McKibbon, 2015; Stake, 1995, 2005, 2006). Researchers also support purposeful sampling as a way to avoid creating a broad scope for research, including narrowing according to time, place, activity, definition, or context (Creswell, 2003; Gentles, Charles, Ploeg, & McKibbon, 2015; Miles & Huberman, 1994; Njie & Asimiran, 2014; Stake, 1995, 2005, 2006; Yin, 1981, 2011, 2018). Purposeful sampling is used to identify selections that are information rich related to the phenomenon selected (Etikan, Musa, & Alkassim, 2016; Gentles, Charles, Ploeg, & McKibbon, 2015; Palinkas et al., 2015; Stake, 1995, 2005, 2006; Yin, 1981, 2011, 2018). These data, "must rest upon multiple sources of evidence, with data needing to converge in a triangulating fashion" (Yazan, 2015, p. 142). This was the best method to use in this research because the research question was specifically created to find information about workplace self-efficacy, so it was important to narrow the population to meet this need. Another way to use purposeful sampling is choosing specific people from a population. This was not chosen as the method of sampling because this level of specificity was not needed.

The sample size was six participants, or large enough for saturation data to be reached. The sample size chosen for this research was supported by Yin (2011) and was more than sufficient, according to Stake (2005). Saturation is reached when no new

information is gained from a participant's interview (Stake, 1995, 2005, 2006; Yin, 1981, 2011, 2018). This was determined when no new information was collected.

Recruitment of interview participants. The first six participants who responded to the joint email sent from the researcher and the [redacted] were interviewed (see Appendix C). The [redacted] provided site authorization to conduct interviews (see Appendix A). The sample was purposeful; it only included a group of adults because they were working individuals. Children are also trained at LearningRx, but their data would not sufficiently answer the research question. Four emails were sent to gain more interview participants, but no others could be recruited.

Artifact sample. Purposeful sampling was used for all artifact data. The exit artifcats were chosen because they showed the participants' perceptions of their programs. Other artifacts LearningRx collects include consultation, training notes, task flow sheets, and progress discussions. The [redacted] LearningRx center agreed to provide all artifacts. This was 26 artifacts collected in total. These artifacts were client exit notes that describe client perceptions about social-emotional and workplace concerns. All notes were deidentified when given to the researcher. For a case study, Yin suggested using data from these most commonly used sources: documentation, archival records, interviews, direct observation, participant observations, and physical artifacts (Njie & Asimiran, 2014; Stake, 1995, 2005, 2006; Yin, 1981, 2011, 2018). These artifacts were chosen because they were both complete and met the participant descriptors above.

Attrition. Attrition is always a concern in research. To address this, the initial recruitment email was sent to all participants over the age of 18 who attended the

[redacted] LearningRx center between 2016 and 2018. This was estimated to be 40 adults**.** Attrition was not applicable with the artifacts, as they already existed. Attrition could have occured during the interview process. If this occured, any data would have been included in the analysis.

Confidentiality. Confidentiality was maintained throughout this study. Once data were collected, the participants were labeled with pseudonyms to not provide any identifying information. The center deidentified artifacts prior to providing them. All electronic and paper documents have been kept either on the researcher's home server or in her home safe during and after the research process.

Sources of Data

The next section incudes discussion of the sources of data, including the participant interviews, member checking interviews, and artifact data. This section will include a description of each data source. The data were collected from LearningRx in [redacted] with assistance from the [redacted] of Cognitive Research. All three forms of data were qualitative in nature.

Artifact data. The artifacts collected are used by each center in the LearningRx system. They include self-reported information from each participant about perceptions of their own experiences in the LearningRx brain training program. All data are self-reported, so they are not modified by LearningRx employees. Each artifact includes concerns, improvements, changes in skills, goals, and feelings throughout the program. These artifact data are qualitative in nature.

Participant interviews. The first 10–15 participants to respond to the recruiting email were interviewed with a researcher-conducted interview (see Appendix C). The

interviews consisted of 10 open-ended questions, including ones about self-efficacy (see Appendix E). The interviews with each participant were between 45 minutes and 1.5 hours in length. The questions were developed by the researcher to ask the participants to reflect on any improvements or changes in their lives after their program. This researcher asked them to reflect what life was like before training and why they chose to participate in the program. Probes were used during the interview to gain additional information or to clarify answers. The questions related to the research question because they asked about aspects of self-efficacy. The questions were not field tested or reviewed by a panel.

Member checking interviews. The member checking interviews were conducted after the initial data were collected and a primary analysis was completed (Koelsch, 2013). These were used to clarify any answers given or to ask additional questions based on prior findings. Some examples of questions that may have been asked during this interview were: Can you give me examples of how you have shown more belief in yourself at work; can you give me an example of ways you might not have believed in yourself; what are some ways your employer may have recognized your improvements? Member checking questions could not be predetermined but were decided based on data.

Trustworthiness

Trustworthiness. Trustworthiness is confidence in both the procedures and the results of a qualitative study. The four trustworthiness criteria used in this study were established by Lincoln and Guba (1985; Shenton, 2004). These four criteria were: credibility, transferability, dependability, and confirmability. These constructs are critical to ensure stakeholders accept the research and the information gained is useful.

Credibility. Credibility, or truth, involves the researcher's asking if the results are believable and truthful (Anney, 2014; Golafshani, 2003; Lincoln & Guba, 1985; Shenton, 2004). Lincoln and Guba (1985) stated that credibility is one of the most important criteria for establishing trustworthiness. Researchers can use several strategies to ensure their research is credible: using well established research methods, triangulation, random sampling, examination of prior research, reflective commentary, and member checks. Member checks were used in this study, and prior research has been examined thoroughly. Triangulation is verifying data against other sources, such as other interviews (Lincoln & Guba, 1985). As data were supported or confirmed by other participants or by the artifact data, the data were triangulated.

Transferability. Transferability is showing the research is applicable in similar situations (Anney, 2014; Golafshani, 2003; Lincoln & Guba, 1985; Merriam, 1998; Shenton, 2004). The focus of qualitative work is typically on smaller populations, so being able to show findings are applicable to other similar settings is important. Stake (1994) suggested that transferability should not be rejected simply because a case is unique; it still is an example of a larger group, so it could potentially be applicable. Though the sample size was small, this researcher attempted to make implications for a larger population.

Dependability. Dependability, or consistency, is the ability of a researcher to show the research can be replicated (Anney, 2014; Golafshani, 2003; Lincoln & Guba, 1985; Merriam, 1998; Shenton, 2004). The researcher should ask if his or her research can be repeated by others at any time. Lincoln and Guba (1985) argued that dependability and credibility are closely tied; one demonstrates the other. Dependability can be reached

by using overlapping methods in the research design. To demonstrate dependability, the researcher should address research design, implementation, data gathering, and reflective appraisal. This researcher ensured dependability by following procedures in each interview exactly. All details of the research were checked to ensure they could be replicated by another researcher.

Confirmability. Confirmability refers to the neutrality of the research, the results verified using triangulation (Anney, 2014; Golafshani, 2003; Lincoln & Guba, 1985; Shenton, 2004). The researcher should ensure the results presented are accurate. In qualitative studies, this is particularly important because a participant's viewpoint is represented. Audit trails and reflexitivity can be used to ensure confirmability. Audit trails are procedural records maintained by the researcher. Reflexivity is how researchers reflect on their own biases, backgrounds, and perspectives throughout the project. This helps researchers neutralize their own biases. This researcher used Rev.com to transcribe all interview notes. This ensured accurate represention of the participants. Reflection was also used on the researcher's own biases and ensured they were set aside.

The LearningRx artfacts used for the data collection are used throughout the entire system with every client (LearningRx, 2015). These instruments were created by the panel of writers who created the program. LearningRx also has a scientific advisory board that oversees and advises the brain training programs. These panels include a clinical neuropsychologist, a neuroscientist, an educational psychologist, a speech/language pathologist, and a statistician.

These collection instruments are used as standard practice among all centers in the United States (LearningRx, 2015). Artifacts can be used in studies as a collection method

for data (Eisenhardt, 1989; Stake, 1995, 2005, 2006; Yin, 1981, 2011, 2018). Case study researchers study phenomena within their natural settings, so collecting these artifact data allowed me to consider the participants' lives as they were experiencing change (Ellis & Levy, 2009; Stake, 1995, 2005, 2006; Yin, 1981, 2011, 2018). Because of this consistency, the data collected were assumed to be trustworthy. Triangulation of data was achieved by using multiple sources of data and examining for saturation (Bloor, 1997; Cho & Trent, 2006).

Data Collection and Management

This section is a discussion of the process for data collection and the management of these data. Data collection and management procedures will be described for the participant interviews, member checking interviews, and the artifact data. Management of all data will also be discussed in this section.

Participant semistructured interviews. After the recruitment email was sent out, the first 10–15 people who responded were contacted for an interview (see appendix C). When each participant responded, a time was arranged to meet at the [redacted] LearningRx center for the interview. Each participant interview was conducted one-on-one, in person, and was between 45 minutes and 1.5 hours in length. Per Yin (2018), the interviews were recorded on the researcher's personal device after obtaining informed consent (see Appendix B; Stake, 1995, 2005, 2006; Yin, 1981, 2011, 2018). Each interview was fluid and comfortable for the participant instead of rigid and was conducted much like a guided conversation (Stake, 1995, 2005, 2006; Yin, 1981, 2011, 2018). Ten interview questions provided an opportunity to explore each participant's perceptions of their experiences with the LearningRx program. Raw data were

transcribed from the interview recordings and readied for analysis using Rev.com. All IRB guidelines were followed during the interview process.

Member checking interviews. The second set of interviews were the member checking interviews. These interviews were conducted once the first interviews were done and the initial data analysis was completed. These interviews were used to further clarify and understand the answers given during the first interviews (Koelsch, 2013). These interviews allowed the participants to comment on the researcher's analysis and understanding of what was said. Per the initial informed consent, the interviews were recorded on the researcher's personal device (see Appendix B). These additional raw data were transcribed from the interview recordings and readied for analysis using Rev.com. All IRB guidelines were followed during the interview process.

Artifact data. The artifact data were collected from the [redacted] LearningRx center. The researcher drove to the LearningRx center and picked up the artifacts from the director. Permission was obtained from the [redacted] of Cognitive Research for the use of all data. The [redacted] passed along authority to the [redacted] center to collect and distribute this data for the current study because it has been designated as a research center. Each piece of data was deidentified before being passed to me. The documents included the participants' immediate reflections about their LearningRx program. This included improvements, changes, test scores, and next steps the participant can take.

Data management. Data management was vital during this process. All written records were held in the researcher's home safe. Each electronic interview was downloaded and kept on the personal home server. After 3 years, all raw data will be

destroyed using data destruction software. However, the data from the data analysis will be maintained for use in further publications or research projects. All clients were notified of this and given the option to have their personal data destroyed and deleted from future publication.

Data Analysis Procedures

For the research question, these collected data were analyzed using inductive analysis (Hatch, 2002). Inductive analysis is a process that pinpoints, examines, and identifies themes in interviews and notes (Braun & Clarke, 2006). Themes were identified across all sources of data. This section will discuss the data analysis procedures that were used in this study.

Problem statement. It was not known if adults who graduate from a ThinkRx in-person, one-on-one brain training program perceive self-efficacy changes in their lives.

Phenomenon. The phenomenon studied was self-efficacy. Self-efficacy is defined by Bandura as a person's belief in their own abilities, specifically in their work performance (Bandura, 1977). The study examined self-efficacy in the participants' lives. The following research question served as a guide in this qualitative study:

$RQ_{1:}$ What are the perceptions regarding self-efficacy and workplace concerns after completion of a ThinkRx brain training program?

Inductive analysis. The inductive analysis was used for all forms of data using a nine-phase approach. Inductive analysis was used because it allows the specific information found in the artifact and interviews to be generalized (Hatch, 2002). Connections are found between elements within the data, and patterns are found across all forms of data. First, analysis was done within each data collection strategy: (a)

participant interviews, (b) member checking interviews, and (c) artifact data. Codes were then collapsed to discover major themes across all data. According to Hatch (2002), the steps in this inductive process are (see Appendix H):

1. Read all data and identify frames of analysis.
2. Create codes based on relationships discovered in step one.
3. Identify important themes, assign codes, and set other themes aside.
4. Reread data, refining the important ideas, and keep record of where relationships are found in the data.
5. Decide if your codes are supported by the data and search for examples that do not fit.
6. Complete the analysis within the codes.
7. Search for themes across codes.
8. Create a master outline expressing relationships within and among codes.
9. Select data excerpts to support the elements of the outline.

Coding. Values coding was used in this inductive analysis process (Saldana, 2016). Values coding reflects a participant's values, attitudes, and beliefs from his or her perspective. A value is the importance a person places on a thing, person, or idea. An attitude is the way a person thinks or feels about themselves, a thing, or an idea. A belief includes both values and attitudes, plus a person's experiences, opinions, and perceptions about the world. Each code was labeled according to values, attitudes, or beliefs.

As each important idea is read, a "V," "A," or "B" was assigned to represent value, attitude, or belief (Saldana, 2016). Along with the coded sentence or expression, a short phrase was written as a description. Once all codes and corresponding phrases were

assigned, these codes were categorized according to a collective meaning, interaction, or relationship.

Participant interviews. Raw data were transcribed from the electronic recordings using Rev.com. Data were examined for self-reported life and work improvements and self-efficacy improvements reported by the participants. These improvements are perceptions of changes their home and work lives. See Appendix H for the complete data analysis process.

Member checking interviews. Raw data were transcribed from the electronic recordings using Rev.com. Data were examined for clarification of prior answers given or additional answers based on prior findings. See Appendix H for the complete data analysis process.

Artifact data. The artifact data were analyzed using the same process; however, no transcription was necessary because these were artifact data. See Appendix H for the complete data analysis process.

Triangulation. Triangulation is defined as the use of multiple data sources or multiple methods that converge to develop an understanding of a phenomenon (Stake, 1995, 2005, 2006; Yin, 1981, 2011, 2018). Having the artifact data, the researcher conducted interviews, and the member checking interviews allowed for triangulation and understanding of the phenomenon (Koelsch, L. E., 2013). By having more than a single source that demonstrates understanding, the researcher was able to provide more data to answer the research question.

Ethical Considerations

The following section will discuss the ethical considerations prior to and during this research. These were important to consider so bias was addressed prior to the study and participants are protected. IRB approval was obtained prior to conducting this study.

Bias. There may have been an unavoidable bias because the clients participating in the LearningRx program may be in higher income brackets. LearningRx has a high cost that may be prohibitive to some people. In addition, qualitative research, by nature, may have bias because it is looks at a specific phenomenon, so it is not generalizable (Hatch & Stake, 1995, 2005, 2006; Yin, 1981, 2011, 2018).).

Personal bias. Some internal bias may exist because the researcher was an employee of LearningRx between 2013 and 2015. To date, some contracted services are provided to one local franchise. To decrease bias in the artifact data, the [redacted] deidentified artifact data prior to giving the researcher these data.

Participant protection. All participants were assigned a pseudonym during the interview process. All audio recordings and coded data were encrypted using a 128-bit encryption process on the researcher's personal server. The researcher will keep the raw data for no more than 1 year postdissertation. After 3 years, the analyzed data will be destroyed. The final coded data may be used in future research. After 5 years, all data will be destroyed by the researcher using the C-Cleaner shredder application, which replaces hard drive dead space with new content on the researcher's personal server (CCleaner, 2017). Any paper will be destroyed using a microcut industrial shredder to ensure destruction of information.

A $50 gift card was offered as an incentive for participation to a randomly drawn person in the study. The names were all placed in a hat and one person's name was

drawn. This gift card was sent to the person through the United States Post Office. This incentive was not intended to be offered in the original plan, but the incentive was added to encourage participation.

Artifact protection. All names from each artifact were deidentified by the [redacted] and pseudonyms assigned. Paper documents were kept in a safe at the researcher's home. The researcher will keep the raw data for no more than 1 year postdissertation. After 3 years, the raw data will be destroyed. The final coded data may be utilized in future research or papers by the researcher. Findings will be shared with the [redacted] Cognitive Research.

Limitations and Delimitations

Limitations and delimitations are present within research. Limitations are items of which the researcher has no control, whereas delimitations are things the researcher may have placed into the research (Simon & Goes, 2012). Limitations may bias the study because the researcher may attempt to infer cause. This was controlled by the researcher by reading and rereading all data multiple times to stay focused on the participants' perceptions. Bias could not be avoided but could be controlled for the second limitation below. The researcher had to ensure more was not inferred from the data than was indicated by the artifact. Though the data set included phrases and not complete thoughts or sentences, the researcher had to accept them as true. The following limitations and delimitations were present in this study:

Limitations.

1. Causal inferences cannot be made from a case study; therefore, further quantitative research will need to be conducted to study any possible causal relationships. Causal inference can only be made when analyzing quantitative data. Qualitative data cannot determine this relationship.

2. Because the artifact data are pre-existing, the researcher did not have to opportunity to question or clarify data. This is a set of information that is collected from all clients and their families during the LearningRx program. This may include social desirability bias on the part of the participants.

3. Sample size was a limitation in this study. This was a small sample for participant interviews. Future research could interview a much larger sample from across the United States. This could have limited the amount of new information collected.

4. Since the artifact data is a secondary form of data not collected by this researcher, there was no control in how the data was collected. This lack of data collection control may be a limitation.

Delimitations.

1. Geographical location of research participants was limited because purposeful sampling was utilized and only one location was used to collect data.

2. The timeline of the participants' programs was a delimitation because they all participated between 2015 and 2018. Because the programs were completed, these artifact data are historical in nature.

3. The program chosen for this study was the LearningRx Brain Training program. Other programs were ruled out because of the scope and individual nature of the LearningRx program. Generalization to other programs labeled as brain training may not be warranted.

4. Limiting the research question to only include the work environment was a delimitation of this study. This focus could have eliminated participants discussing their relationships and home life in more detail.

Summary

This chapter focused on the research questions, methodology, design, data, and analysis. This qualitative descriptive case study was an exploration of the self-efficacy of adults who completed a ThinkRx brain training program at LearningRx centers in [redacted]. The research was conducted by collecting existing artifacts from the LearningRx center in [redacted] pertaining to adults who completed a ThinkRx cognitive skills program between 2016 and 2018. These documents included self-

reported perceptions about their ThinkRx program. These documents included data from 26 adults who participated in a LearningRx program between the years 2016 to 2018. These artifacts were collected during the celebration with the participant, family and friends who were invited, and the Program Director. Additionally, the researcher conducted an interview and member checking interview with each participant. These interviews were between 45 minutes and 90 minutes long. Over 100 pages of interview transcripts were collected in these two sets of interviews. Six participants were interviewed during this process. The member checking interview was not as fruitful, as only three participants were able to participate, even though all six originally agreed to do a second interview. Self-efficacy was generally defined as a person's belief in his or her own ability, specifically related to work performance (Bandura, 1977).

Chapter 4 will present the procedures for analysis and how the researcher utilized the findings to answer the research questions. The inductive analysis will be discussed and major themes supported with information from the data collected. Throughout the theme discussion, the researcher will provide quotes from the participants that support each theme. The research question discussion will show which themes support the question and which themes did not. Finally, Chapter 5 will discuss the research findings and provide a summary. Implications of this research will be discussed. It will also provide recommendations for further research.

Chapter 4: Data Analysis and Results

Introduction

The purpose of this qualitative case study was to examine how self-efficacy perceptions improve for adults who completed a ThinkRx brain training program between 2015 and 2018 at the LearningRx center in [redacted]. This research was a qualitative case study that used inductive analysis to examine the collected data. The three forms of data that were collected were exit artifacts, a participant interview, and a member checking interview. Self-efficacy, people's beliefs in their workplace abilities, was the phenomenon studied in this research (Bandura, 1977, 2006, 2008, 2012). Self-efficacy is different from self-confidence or self-esteem. It is the deep belief in one's own abilities to achieve in the workplace. The following research question was constructed to address the problem statement and guide this study:

RQ_1: How do adults who completed a ThinkRx brain training program perceive their workplace self-efficacy?

Chapter 4 provides an overview of the study methodology, research question, summary of sample characteristics, data analysis procedures, and findings from the study. The reader will be introduced to each of the participants, including why they started a LearningRx program, their concerns prior to the program, and some of their desired changes since completing the program. Descriptions will be provided for the daa analysis procedures used in this study. The themes developed from the data offer insights gained by participants reflecting on their perceptions of the changes experienced during and after their brain training program. Chapter 4 also explains how the data were prepared,

managed, and analyzed. Chapter 5 concludes with a summary of the study and findings, conclusions, implications, and recommendations for further studies.

Descriptive Findings

Artifact participant descriptors. All 26 participants attended the LearningRx Brain Training Center in [redacted]. The eligibility criteria are as follows and the Program Director at the [redacted] LearningRx center ensured each participant included met the criteria. They each completed a brain training program between the years 2015 and 2018. Each participant is now over the age of 18 but may have completed the program prior to turning 18. These participants each completed a Woodcock-Johnson III cognitive skills assessment prior to their program, completed the ThinkRx program, took the Woodcock-Johnson III as a postassessment, and completed a celebration document with the program director at the [redacted] center. The celebration documents are the artifacts this researcher collected from the program director at the [redacted] center.

This group of participants included 12 men and 14 women, with a total of 26 participants. The ages of participants starting the program ranged from 15 to 69. The professions of these participants included the following: student, insurance agent, financial planner, retired, veterinarian, car mechanic, martial arts instructor, and military. All artifacts collected were deidentified by the program director at LearningRx prior to being given to this researcher. They were lettered randomly by the director so the information could not be easily identified.

Interview participant descriptors. All six participants attended the LearningRx Brain Training Center in [redacted]. They each completed a brain training

program between the years 2015 and 2018. Each participant is now over the age of 18, though two participants completed their program prior to turning 18. Each participant agreed to both an initial interview and a member checking interview, if needed. This group included three women and three men, all of whom completed a ThinkRx program over one year ago. Descriptions of each participant follows this general description and are pseudonyms of participants. All 26 participants included in the artifact data were invited to participate in the interviews. Interviews were conducted until saturation of data was reached. An overview of all participants is presented in table one below. The current ages of participants was 31.8 years, included three males and three females, and the interviews lasted an average of 1.04 hours. When these participants originally participated in their LearningRx program, their ages ranged from 16 to 69 years old.

Table 1.

Interview Participant Information

Participant	Gender	Current Age	Ethnicity	Profession	Age During Brain Training Program	Length of Participant Interview	Number of Pages in Transcript
Sarah	Female	22	White	Teaching / Research Assistant	21	1:20	18
Scott	Male	21	White	Navy	17	:55	10
Ruth	Female	72	White	Insurance Sales	69	1:10	15
Tina	Female	19	White	College student	16	1:15	17
Lee	Male	35	Asian	Phd student / Veterinarian	32	1:25	19
Henry	Male	22	Indian	PhD student / Physical Therapy	35	1:00	13
Averages		31.8			30	1.04	14.3
Ranges		19-72			16-69	:55-1:20	10-19

Participant 1: Sarah. Sarah is a 22-year-old woman who attends college and is working as both a teaching assistant and research assistant. She attended LearningRx when she was 21 years old. She is currently a neuroscience major in college and aspires to be a researcher when she graduates. This researcher was able to interview her at the [redacted] center since she still resides in [redacted]. Sarah was talkative, yet quiet in her mannerisms even though she divulged much information during her interview. She stated several times she was glad to interview even though she seemed a little nervous. She did lean in during her interview and was engaged the entire time.

Sarah spoke of struggles she had before her training such as strained relationships, having to reread assignments multiple times, not being able to comprehend, lack of focus, feeling like she was not smart enough to be in class, and feeling like she was making life

choices because others directed her. She stated she often felt she was hiding and studying for 10 hours, “when other people would study for two hours or something.” She also said she, “knew that I was slower and I thought I wasn’t as smart as them so I just had to put in more effort, when really there were other options where I didn’t have to…and that’s what really made everything so painful.” The pain in her voice and the expressions on her face were obvious to this researcher.

Sarah chose to attend LearningRx because she had tried other interventions such as tutoring. Throughout the interview, Sarah expressed delight in her choice to attend this brain training program. She even said, “I always wanted to push past that perceived notion of myself that people had on me and I had on myself.” When asked specifically about relationships both prior to and since her program, she was reflective. “I didn’t really think, like getting my needs met was the most important thing. So, I kind of didn’t really acknowledge when people would call me stupid, it didn’t affect me that much. I was just like okay, if they think that. But I think deep down it did affect me.” She now realizes how much she lacked in human connection because she was scared, but she is not afraid to interact with others now and share her feelings and needs. She now feels like she belongs in the room and has things to contribute.

Participant 2: Scott. Scott is a 21-year-old man who is an active duty member of the United States Navy. He is a Boatswain’s Mate and would be working on an aircraft carrier deck in 2 months. He had completed basic training in November 2017. This interview was conducted by telephone because this participant resided in another state. He was very excited to interview and was very talkative. He did not seem nervous at all. He even asked if he would be able to read the results of this study once it was completed

because he was interested in how others felt. He and his parents chose to send him to attend LearningRx when he was 17 years old because they had tried several other interventions with no success.

Prior to his program, Scott had to be pulled from school to do online home schooling. He felt, “I just had no motivation at all to get those done. I did not like school at all. I did not like doing homework. I didn’t like taking tests. I didn’t like anything because I struggled with it and I was not doing so I never looked forward to any of it. Never had a goal, never had a plan.” He was also identified as having attention deficit hyperactive disorder (ADHD) and took medications for it. Scott complained about lack of focus, not being able to complete a task, getting poor grades, not getting along with his parents, and not feeling successful. During his brain training program, Scott was able to stop taking his medications for ADHD and still does not have the need for these.

Since his program, he listed many improvements: grades, college, success in college, played college baseball, joining the Navy. He affirmed, “I decided to take a better role and do better in life.” He expressed several times about his increase in his confidence. “I just learned the time to do things by, when to get them done, how efficient to get them done, and everything like that. And I did it. It was so good to know that I can do it and I can still do it at a higher level.” He even said he now has better relationships with his parents and even hugged them at his graduation from Navy boot camp. At one point, Scott stated enthusiastically that he was confident he could do anything.

Participant 3: Ruth. Ruth is a 72-year-old female who has been a successful business owner for over 20 years. She began her program at LearningRx when she was 69 years old and completed a full program. This interview was conducted at the

participant's office because that was a more comfortable environment for her. She was extremely talkative and anxious to share many stories to illustrate her perceptions. She seemed to feel more confident in her answers because she was in her daily work environment. She interacted excitedly with her staff prior to interviewing, even sharing what she was doing.

Before she began her program, Ruth's complaints were things such as lapsing memory, never really learning to read, surrounding herself with others who filled her weaknesses, depression, and unorganized living. Ruth told the story of when she was a young girl in school and, "developed a coping conartistry so that no one discovered my issues." She could not discriminate between sounds in words, but graduated college after working extremely hard. She even became a teacher but had to create her own way to cope during teaching. If she had to write on the board, she would ask a student to write so she could talk and generate ideas while the student wrote for her. "They didn't know I couldn't spell. I was a real con."

Prior to and during her program, she tried nutritional changes, exercise, and working with her doctors. She did not feel those interventions made the full impact she wanted. Ruth chose to attend LearningRx because of the changes she saw in the owner of the [redacted] LearningRx center after he completed his own program. Now she has freed up time because she was, "able to face my demons." She said she felt depressed when she first attended but would feel things change midsession:

> The session was an hour and 15 minutes, I think, so about 50, 55 minutes into our training, I'd be like, oh wait a minute. Something just happened. I would feel

> something inside my brain. It was like a chemical was released or something. I'd shake my head even, and I'd go, whoa, something just happened.

Ruth also said she was having other physical reactions when she was training, such as her body temperature rising.

Ruth expressed excitement about other improvements since training. She spoke of retaining things on her own, feeling better about herself, and being more engaged in the community. She was also able to complete things that were only dreams prior to training. She is traveling more and remembering trivia during her trips. During conversations she is now controlled with her listening and asks more questions. She called herself a "chatterbox" prior to her training. Others in her circle have noticed her improvements, including her internist. He even calls her, "his posterchild of a 72-year-old."

Participant 4: Tina. Tina is a 19-year-old woman who is attending a fashion and design college. She is currently hunting for an internship in the fashion industry while attending school. This interview was conducted at the [redacted] center because the participant was on her Christmas break from school. She seemed to want to prove how much she had improved since her program and was very excited to interview. She shared several stories and examples during her interview. She sat back confidently during her interview and was not shy about sharing. She attended her program when she was 16 years old because her parents felt she needed additional help. Tina's challenges included task completion, attention, living up to a poor reputation, not fulfilling her potential, poor reading, and poor spelling. She said when she was young, people used to think she was a smart girl and everyone wanted to work with her, but things changed around the 8th

grade. People began to see the skills she lacked and began to treat her differently. She then began to fulfill expectations of others through her behavior.

Since completing her program, she now feels more confident and is willing to stand up for herself. She even said, “you can tell me how dumb you think I am and how I can’t do it, but I know that I can.” She now lives on her own in a large city in California to attend school. Even though she doesn’t know where her path will lead her, she knows, “I’m where I’m supposed to be.” Tina gave examples of times she has had to stand up for what she believes and not accept people trying to take advantage of her. She is controlled in those moments and continues to stay focused on her goals.

Participant 5: Lee. Lee is a 35-year-old man who is a veterinarian currently studying for a PhD in Canada. He attended LearningRx when he was 32 years old. This interview was conducted by telephone because the participant resided in Canada, attending school. Lee was exited to share his experiences and stories of his improvements. He was very talkative and expressive and indicated he had kept notes of his improvements throughout his program. He was very interested in how the study was being conducted and wanted to hear results once the study was completed. He was not shy about discussing both his concerns prior to his program and his improvements.

He struggled with memory prior to attending a LearningRx program and was referred by one of his professors. When he was in his residency, he would have to record the lectures, take notes, listen to the lectures again, and put many hours into studying. Lee felt he was working too hard and putting too much effort into remembering things. He stated he could drill himself with flashcards over and over, then 20 minutes later he would forget what he studied. Lee also complained about his processing speed. He felt he

did not have strong enough processing speed to efficiently store things in his memory. During this time, he also put pressure on himself to remember everything, which did not help his stress.

Now, he is in Canada completing a PhD program and focused on his goals. He described improvements such as more focus, efficiency in completing tasks, not having to reread material, being more organized, and having more self-reliance and self-confidence. His biggest improvement is being less stressed. Lee also described, like several other participants, his ability to stand up for himself when confronted with problems or "bullying." He is also willing to ask for assistance or clarification in class instead of just accepting that he does not know something. Relationships for Lee have also changed, and he said that his family is, "less concerned in certain ways."

Participant 6: Henry. Henry is a 29-year-old man, Veteran of the armed forces, and studying to obtain his PhD in physical therapy. This interview was conducted by telephone because the participant was performing clinical rounds in Wyoming. Henry was a very confident, yet quiet individual. He shared examples of how his improvements have impacted his life. He was not shy about sharing and was interested in how the results would be used. He went to LearningRx because he stated he would spend all day studying and not finish tests. He would do well on the parts of assessments he would finish. Henry felt he was constantly falling behind in his studies and knew if he wanted to go into a masters or PhD program, he would have to make a change. He also felt challenges in his personal relationships because he was not able to spend time with people because he was engrossed in studying. During this time, Henry was upset with himself because he felt school was not for him. He wanted to help people and wanted to

enter the physical therapy field but felt this may not be an option unless something changed.

Since his training at LearningRx, his improvements have included improved grades, less time studying, test completion, enjoying school, and being happier. His relationships also developed "drastically" since his program. Another enhancement since his program is his ability to implement more self-care into his daily routines. He takes time to eat well and do more physical activity. He is also more able to set goals for himself and take the steps to achieve those goals. Henry was accepted into an elite program for his next residency and will be able to serve both active duty military and veterans. He shared that he wants, "to work for the people that are allowing us to be able to practice that freedom that we have in this country. I want to be sure that they get the care first because I think those people are important beyond all measure to this country."

Data sources. Three data sources were used in this study: (a) 26 artifact data collected from the [redacted] LearningRx Center, (b) six participant interviews, and (c) four member checking interviews. The artifact data were originally collected at the end of each participant's LearningRx one-on-one brain training program. These were collected during a celebration that included the participant, any family they wanted to include, the participant's brain trainer, and the program director from the [redacted] center. The face-to-face interviews were originally intended to be conducted at the [redacted] center; however, because some of the participants resided outside of the [redacted] area, some interviews were conducted via phone. All interviews were recorded using the Rev.com app and transcribed through Rev.com.

Artifact data. The artifact data were a set of secondary collected data collected originally by the program director of LearningRx with input from the participant and the participant's family, if they chose to participate. This was an informal discussion and reflection that occurred directly after the 26 participants completed the ThinkRx program. Because this was completed right after the program, the questions and reflections were current and fresh in the participant's mind. These questions were asked by the program director, and the participant had the opportunity to answer as much or as little as they felt comfortable answering. The answers were then summarized during the meeting by the program director. These documents are kept as a part of the participant's permanent record at LearningRx, along with all assessment and training data. Each participant signed an agreement to participate in future research when they first signed up for the brain training program. These signed documents are also kept as part of the participant's permanent file at LearningRx. There were a total of 26 pages of artifact data collected by the researcher. Each participant was represented by one page of hand written artifacts. The ages were not specified by the Program Director when collected

Participant interviews. The six interviews were private, independent, and semistructured with the same set of nine open-ended interview questions (see Appendix F). The interviews were conducted after contacting potential participants and collecting agreements to participate. The researcher arranged times and dates that worked well for each participant individually. A quiet meeting room at the [redacted] LearningRx was provided for the researcher's use. However, four participants were not able to meet there. Three participants had to do their interviews over the phone because they had moved away from the [redacted] area and were unable to conveniently

meet the researcher. One participant was interviewed in her office and two were interviewed in the LearningRx office. Each participant who was not interviewed face to face was emailed the Informed Consent document and returned it signed to the researcher. Five interviews lasted 60 minutes or more, with only one falling below the one hour time. The interviews were audio-recorded on both an iPad tablet and the researcher's phone as a precaution, in case one technology unsuccessfully recorded. The Rev.com app was used as the recording application on both of the researcher's devices. This is the preferred method of recording, as stated on the Rev.com website (www.rev.com). The audio files were sent to Rev.com, an online transcription service, to be transcribed. The interview transcripts were then loaded to the researcher's secure account on Rev.com then downloaded to the researcher's computer. There was a total of 92 pages double-spaced of participant interview transcripts collected between the six participants who were interviewed. The range of transcript pages ranged from 10 to 19. This is represented in the figure below.

Participant	Length of Participant Interview	Number of Pages in Transcript	Method of collecting interview	Why collection method was used if varied from plan
Sarah	1:20	18	In person at LearningRx	As planned
Scott	:55	10	By phone	Moved out of state
Ruth	1:10	15	In person at her office	More comfortable in her own office
Tina	1:15	17	In person at LearningRx	As planned
Lee	1:25	19	By phone	Moved out of country
Henry	1:00	13	By phone	Working out of state

Figure 1. Participant data with interview lengths, transcript pages, and interview method.

Member checking interview. Each participant agreed to participate in the member checking interview process during the initial participant interviews. Once the initial analysis of the artifact and participant interview data was conducted, the researcher developed a set of two follow-up questions to ask each participant. These questions were based on this initial analysis and encompassed additional information the researcher wanted to gain from each participant. The two questions asked during the member checking interviews were:

1. Describe for me your ability to handle stress and any effect this has had on work, if any.
2. What impact has confidence had on your workplace performance, if any?

These questions were developed because the researcher wanted each participant to expand more on the discussions they had pertaining to stress because emotional control

was one of the prevailing themes. This researcher wanted to see if the participants perceived that lessening stress, as pointed out in the initial interviews, would change perceptions of work. Each participant discussed feeling less stress and having less anxiety. In that same vein, each participant spoke of feeling increased confidence but did not really state if this confidence directly impacted their workplace. Because achievement was found to be a theme, this researcher wanted to discover more about perceptions connecting achievement and confidence.

After several attempts were made to contact all participants, only four were able to complete the member checking interview. The member checking interviews were all conducted over the phone, recorded using the researcher's iPad tablet and phone and transcribed by Rev.com. The duration of the interviews ranged from five minutes to 15 minutes, with the average being seven minutes. The same procedure that was used during the participant interview process was used again in the member checking interview process. The member checking interviews contributed an additional eight double spaced pages of data to the researcher's data. The range of pages was one to three double-spaced pages, with the average being two pages. This brings the total pages of data collected from all three forms of data to 126 double spaced pages of data.

Data Analysis Procedures

Data analysis method. The data analysis procedures discussed in Chapter 3 were used as a guide and modified as the data analysis was completed. The thematic analysis process developed by Hatch (2002) was applied to this research. This process was used for each data collection method: artifact, participant interviews, and member checking interviews (see Figure 2).

Inductive analysis was used for this study and themes emerged from the data. This changes the data from specific examples to generalized themes. Inductive analysis allows researchers to watch for patterns then surmise themes from these patterns within the data collected (Hatch, 2002). The following steps were followed in this data analysis process: data familiarization, open coding, axial coding, and selective coding, the developing themes from codes.All data were analyzed in totality and codes collapsed per data set. Each set of data were analyzed independently of one another first, then the artifact and interview data were collapsed and analyzed together. Once the member checking interview data were analyzed independently, they were compared to the other collapsed set of data.

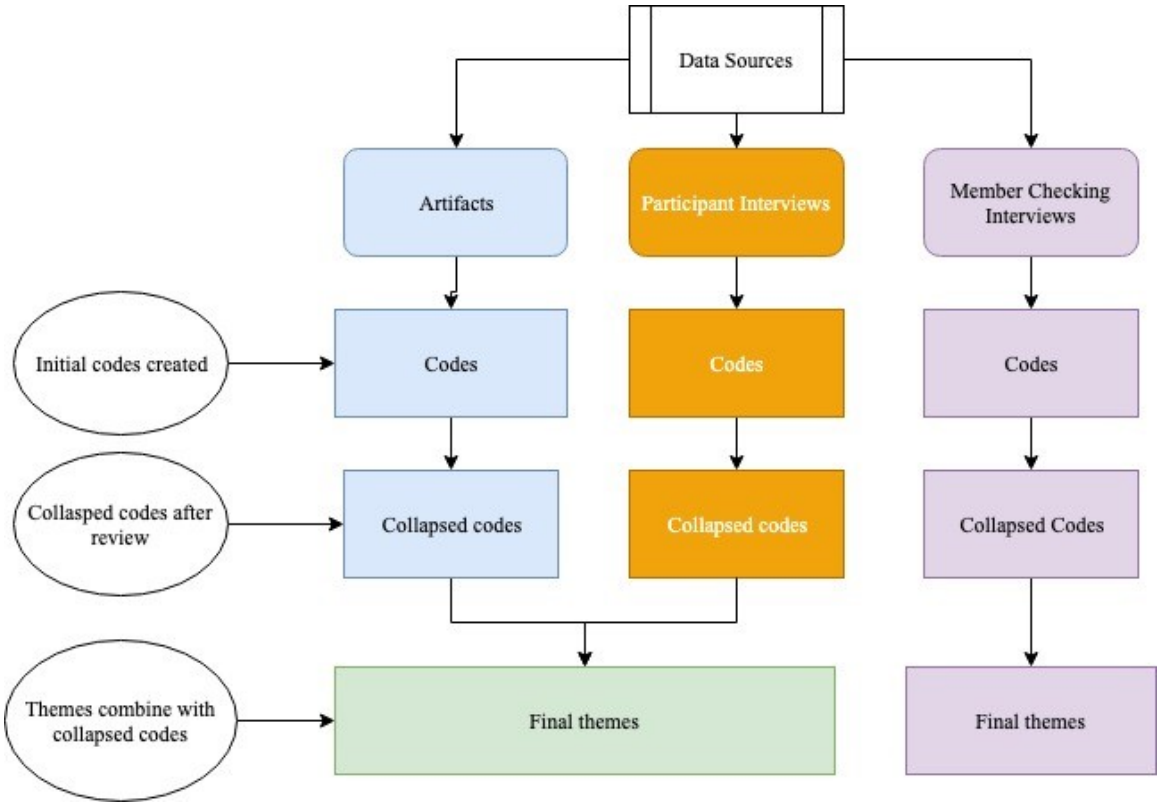

Figure 2. Overview of the data analysis method with the three data sources in this study based on Hatch's thematic analysis process.

The Values, Attitudes, Beliefs coding method described in Chapter 3 was initially used with the artifact data through the initial coding stage (Saldana, 2016). Once the codes were collapsed, it was determined that this method of coding did not lend any additional information about the data and was abandoned. This initial method was going to be used to give the researcher more information regarding the values, attitudes, and beliefs of the participants, but this was inferent in the data itself. This method was abandoned because the additional labels did not lend any additional information about the data. Because the participant data were analyzed independently at the initial coding stage, the researcher made the decision to use the same Values, Attitude, Beliefs coding method. Once the codes were collapsed, the researcher decided to abandon this method completely. These data did not add anything to the study and did not provide the

information needed to complete the analysis. The researcher chose to use open coding at this point because it was deemed to be a more appropriate method for this data (Saldana, 2016). This method allows the researcher to describe what is in the data with short phrases or words. No additional labels for the codes were needed. The entire data analysis process started over using the descriptive coding method with both artifact and participant interview data. An overview of the entire analysis process can be seen in Figure 3.

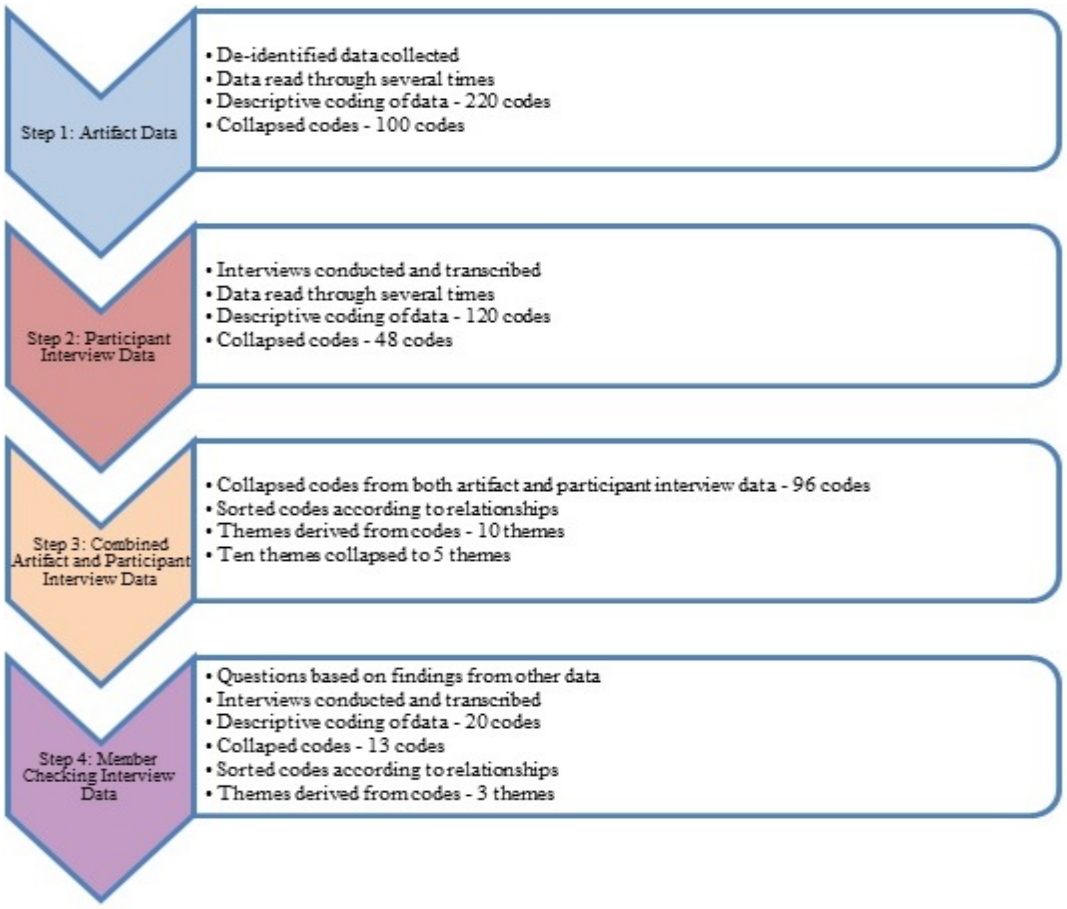

Figure 3. Data analysis process used in this study with examples of what occurred during each step in the process.

Artifact data coding process. The artifact data were analyzed independently from the other data sets while participant interviews were being conducted. The

following steps were followed in this data analysis process: data familiarization, open coding, axial coding, and selective coding, the developing themes from codes.The de-identified artifact data was read twice to gain a complete understanding of the raw data that were collected. The 26 pages of double-spaced artifact data were read through prior to creating the initial codes. Breaks were taken between each transcript to read for both understand and meaning. These data were short phrases and words, which represented meaningful chunks of data. As these steps were conducted, preconceived ideas were set aside and codes were taken from the data itself. This first round of raw coded data was recorded in an excel spreadsheet on the researcher's personal computer and encrypted. Each code was recorded with the raw data from the artifact. In total, there were 162 initial codes created (Figure 4). A code book was created for the artifact data and can be found in Appendix K.

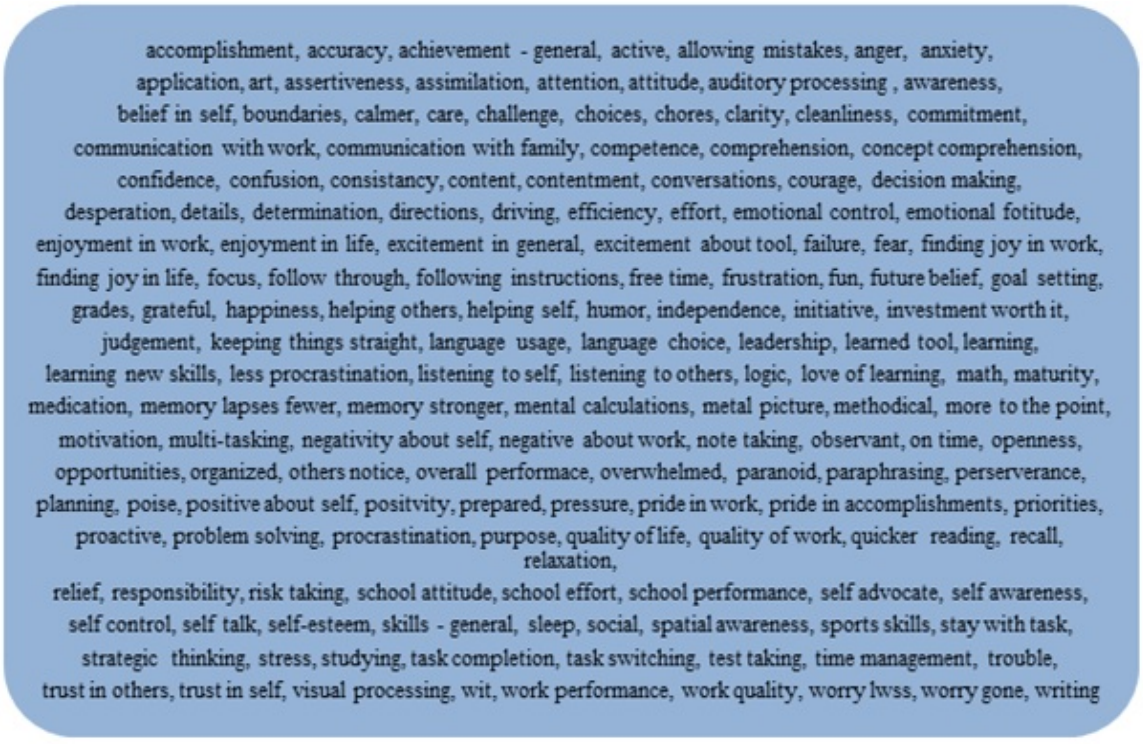

Figure 4. Artifact data: Initial list of 162 descriptive codes.

While reading through the data, the researcher decided if ideas were important or not. This was determined by deciding if the data pertained to the questions asked. If the data supported the question or described a participants' perception, then it was deemed important. If it did not, then it was ignored. After the phrase or word was deemed important, the code was assigned. Along with the coded sentence or expression, a short phrase was written on the artifacts themselves as a description. For example, a code that represents the participant's belief in their future might be labeled with the words "future belief." Once this was completed, the codes were reviewed and collapsed (Figure 5). The 162 initial codes were collapsed to 100 codes. The list of collapsed codes can be seen in Figure 6 below.

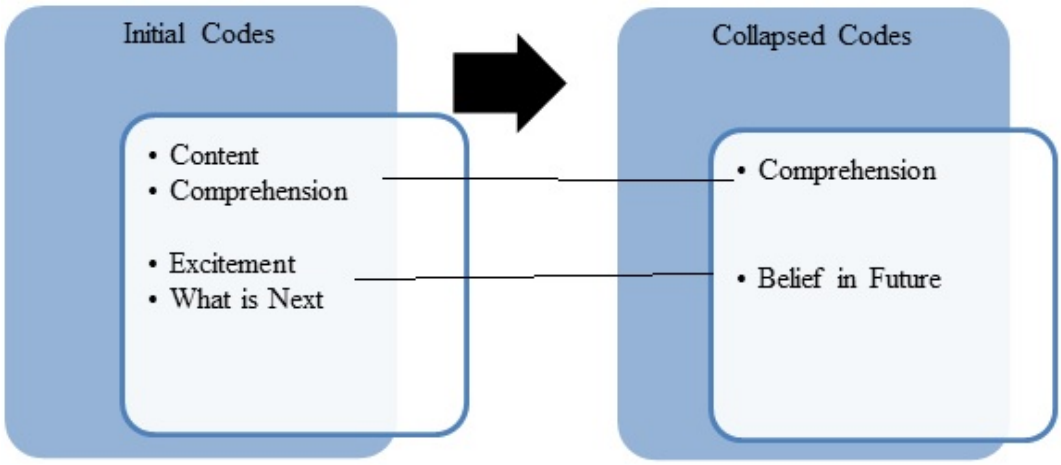

Figure 5. Artifact data: Two examples of moving from initial codes to collapsed codes.

Artifact Data List of Collapsed Codes						
memory	sports skills	attitude	independence	challenge	gratitude	follow through
confidence	emotional control	conversations	studying	clarity	language	medication
focus	happiness	enjoyment	effort	concept comprehension	learning	observant
reading	commitment	self-advocate	humor	details	learning new skills	openness
communication	Logic	determination	initiative	goal setting	motivation	procrastination
grades	positive about self	fear	listening	leadership	school effort	quality of life
belief in self	anxiety	attitude	multi-tasking	maturity	school performance	quality of work
processing speed	Perseverating	conversations	others notice	mental calculations	Sleep	skills - general
future belief	Stress	enjoyment	recall	patience	work quality	task switching
writing	Driving	Self-advocate	responsibility	relaxation	Active	risk taking
comprehension	note taking	determination	trust in self	test taking	assertiveness	visual processing
organized	task completion	helping others	work performance	assimilation	auditory processing	overwhelmed
time management	positivity	overall performance	decision making	boundaries	Caring	strategic thinking
math	self-esteem	chores	efficiency	cleanliness	choices	art
enthusiasm	excitement about tool					

Figure 6. Artifact data: List of all collapsed codes.

Participant interview data coding process. The same procedures were followed in the participant interviews as they were with the artifact data: data familiarization, open coding, axial coding , and selective coding, the developing themes from codes. As

participant interviews were completed, they were sent to Rev.com for transcription. Once all transcriptions were downloaded from the Rev.com website and saved to the researcher's personal computer, all raw data were read twice. All data were encrypted when they were saved to the personal computer. See Figure 6 below for interview times and number of double-spaced pages transcribed for the interviews. A total of 92 double-spaced transcribed pages were created for the participant interviews. These transcripts were then read twice for a complete understanding of the perceptions each participant communicated. The researcher took breaks between each transcript and read for both understand and meaning. A code book was created for the participant interview data and can be found in Appendix L.

Codes were developed based on the inductive thematic analysis developed by Saldana (2016) just as the artifact data were coded. Along with the code, a short phrase was written as a description and included exact quotes from the raw data. For example, a code that represents the participant's belief in their future might be labeled with the words "future belief". This first round of raw coded data was recorded in an excel spreadsheet on the researcher's personal computer, encrypted, and consisted of 81 codes (Figure 8). Each code also included the raw data examples from the interview. Once this was completed, the codes were reviewed and collapsed to 48 codes (Figure 9).

Figure 8. Participant interview data: List of initial descriptive codes.

Participant Interview List of Collapsed Codes		
confidence	processing speed	questioning the future
assertiveness	leadership	business planning
belief in future	reflective	Curiosity
enjoyment	risk taking	not feeling alone
time management	community involvement	professionalism
logical connections	educational achievement	things come easier
relationship	preparation	trust in self
independence	self-control	seeing value in learning
self-care	focus	task completion
emotional control	content comprehension	true to oneself
goal setting	organization	Commitment
belief in abilities	realistic expectations	Ownership
others notice changes	decluttering	Stress
communication	attitude	physical reaction
memory	handling setbacks	future plans
self esteem	helping others	belief in self

Figure 9. Participant interview data: List of collapsed codes.

From codes to themes. Once all collapsed codes were recorded for both raw artifact and raw interview data, the newly named codes were read through three times. Codes that were similar in nature were collapsed to create a total of 96 codes. During this process, relationships were found within the codes. This step took an additional three times of reading and multiple breaks because of the volume of data. All codes were sorted according to a collective meaning, interaction, or relationship (see Figure 10). They were then used to support a theme.

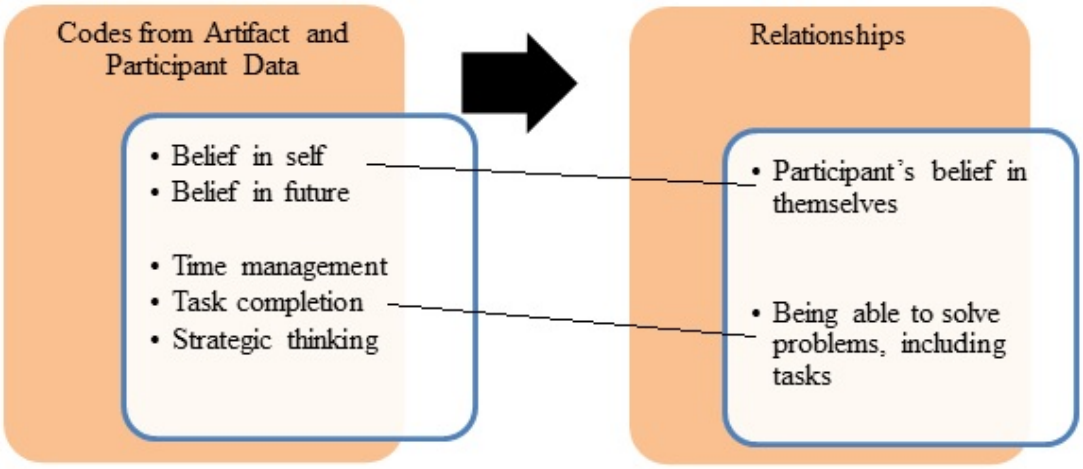

Figure 10. Example of how codes were sorted into groups, to support a theme.

Once all collapsed codes were sorted, the raw data were read through again. The relationships inside each group and across groups were examined to ensure the relationships were satisfactory to the researcher. These relationships were examined to determine how they connected to one another and if a phrase or word could be used to describe this group of codes. These words or phrases were decided upon because they best represented each particular group of codes. These are called themes. A theme represents a pattern that is signifigant within the data. This is determined by the researcher. This researcher asked questions such as: does this theme make sense, do the data support the theme, am I trying to fit too much within a theme, and is there overlap between themes? The relationships within each group were determined to support the themes. Ten themes emerged from the artifact and interview data collected to this point. These 10 themes were reviewed and further collapsed into five themes supported by the codes. A master outline was created that showed all themes and the corresponding codes that supported them (Figure 11).

Themes with Supported Codes Using Artifact and Participant Interview Data				
Self-Awareness	**Problem Solving**	**Emotional Control**	**Achievement**	**Leadership**
confidence	logical connections	stress	memory	community involvement
belief in future	goal setting	reflective	educational achievement	helping others
belief in abilities	preparation	self-control	focus	professionalism
self esteem	organization	attitude	seeing value in learning	business planning
belief in self	realistic expectations	communication	things come easier	curiosity
creating future plans	decluttering	independence	processing speed	independence
risk taking	task completion	assimilation	comprehension	humor
not feeling along	time management	boundaries	time management	responsibility
trust in self	task switching	perseverating	sports skills	
self-care	anxiety	positivity	observant	
true to oneself	communication	enjoyment	efficiency	
effort	conversations	overwhelmed	test taking	
handling setbacks	effort	maturity	cleanliness	
self-advocate	decision making	patience	chores	
others notice	strategic thinking	relaxation	medication	
challenge	details	enthusiasm	skills - general	
clarity	mental calculations	gratitude	driving	
motivation	choices	caring	visual processing	
school effort	procrastination	fear	work performance	
quality of life	planning	Recognizing stress		
quality of work	Assessing situations	Creating coping mechanisms		
determination	efficiency			
happiness				
commitment				
ownership				
expression				

Figure 11. Collapsed themes with supported codes using artifact and participant interviews.

Five themes emerged from the artifact and interview data collected. The five themes identified in the data were self-efficacy, problem solving, emotional control, achievement, and leadership. All themes were supported with a minimum of eight codes. Self-awareness emerged as the prevailing code in the data and was the most often mentioned theme throughout the participant interviews. Interestingly, achievement was the most prevalent theme found in the artifact data. The other themes could possibly influence the participants' beliefs in their abilities; however, this cannot be determined in this research. Three themes support this current research question: self-awareness, problem solving, and emotional control. Definitions of the themes were modified and refined until the researcher felt the definitions defined the codes well. The themes in this research are defined as follows:

- ***Self-efficacy***: One's belief in their ability to achieve, especially in the work environment
- ***Problem solving*****:** Perception of one's ability to recognize, plan for, and attack a problem or situation
- ***Emotional control***: Perception of one's ability to control reactions in situations, stay focused with emotions, and not to have large mood swings. Also, perception of being able to enter a situation without over reacting.
- ***Achievement***: Evidence of being able to achieve at higher levels than before
- ***Leadership***: Willingness to take on leadership positions and perception of showing leadership potential in actions and words

Though not all of the themes directly supported the research question, achievement and leadership are still relevant themes and valuable for future studies. The other themes could be a result of the increased self-efficacy of each participant even though this researcher did not study it. These will also be discussed below. There was a total of 20 codes that were common between the artifact and participant interviews (see

Figure 12 below). These codes help to demonstrate that some perceptions may not have changed for the participants between the time directly after training and the current day. This could be another possible topic to study in the future.

Codes that overlap between artifact and interview data		
focus	attitude	independence
communication	logic	effort
belief in self	stress	goal setting
processing speed	task completion	others notice
comprehension	helping others	risk taking
time management	commitment	trust in self
confidence	assertiveness	

Figure 12. Themes common between the artifact data and participant interview data.

Member checking interview process. Once all codes were analyzed and themes were decided upon from both the artifact and participant interviews, a set of two questions were created for the member checking interviews. These two questions were created from the findings from the artifact and participant interview data. The codes and themes were re-examined. The researcher wanted to know more specifically about the participants' abilities to handle stress and if this had any effect on their work environments. Because achievement came up as a theme, more information was sought to discover if confidence was perceived as playing a part in achievement. These questions could also give more insight into the participants' beliefs in their abilities.

The following questions were developed for the member checking interviews:

1. Describe for me your ability to handle stress and any effect this has had on work.
2. What impact has confidence had on your workplace performance, if any?

The member checking interview process followed the same analysis process outlined above for both the artifact and the participant interview data. The following steps were followed in this data analysis process: data familiarization, open coding, axial coding , and selective coding, the developing themes from codes. Once the data were collected, it was transcribed using the Rev.com website. The raw data were initially coded, but no collapsing of codes was necessary because the researcher felt the codes were sufficient (see Figure 13).

Codes from Member Checking Interview Data		
Assessing situations	Planning	Processing
Prioritize	Efficiency	Recognizing stress
Focus	Task switching	Expression
Self-advocate	Self-care	Test taking
Coping mechanism		

Figure 13. Codes from member checking interview data.

These codes were sorted based on relationships inside each group and across groups. The relationships within each group then lead to the themes. The themes emerged from this set of data alone (see Figure 14). No new themes emerged from these data. These themes supported three of the five themes derived from the artifact and participant interview data: problem solving, self-awareness, and emotional control. There was no evidence supporting the final two themes.

Problem Solving	Self-Awareness	Emotional Control
Assessing situations	Focus	Expression
Prioritize	Recognizing stress	Self-advocate
Planning	Self-care	Coping mechanism
Efficiency		
Test taking		
Processing		
Task switching		

Figure 14. Themes from member checking interview data.

Specific measures were used to ensure the trustworthiness of this study. The participant interview questions were field tested with an expert in the field of brain training to check for clarity. The expert recommended rewording two questions to be clearer and one question to be added. The researcher followed up with the suggested changes. Another measure of trustworthiness was having a peer read and respond to the presented research. The researcher asked a peer in psychology to read the study, respond, and make suggestions. The research was well documented throughout the process and records were kept to ensure dependability. Encrypted audit trails can be found on the researcher's personal computer. Triangulation of data was assured because the researcher interviewed until new information was no longer collected. Upon completion of the data analysis, the research findings were written to address the research question.

Results

This section reveals the results from the data analysis in this study. Qualitative data derived from three data sources: (a) 26 artifact data, (b) six participant interviews,

and (c) four member checking interviews. Five themes emerged from the data: self-efficacy, problem solving, emotional control, achievement, and leadership. The classification of codes by theme is illustrated in Figure 6. Three of the five themes were used to support the research question, as described below.

Research Question 1. How do adults who completed a ThinkRx brain training program perceive their workplace self-efficacy?

This research question was supported by the themes self-awareness, problem solving, and emotional control. Though the other themes did not directly support the research question, they will also be discussed below. These other themes offer interesting insight for this study, as well as implications for future research. The five themes will be discussed first as an overview of each theme (Table 2). Evidence from participants' perspectives is provided to support each theme. The results section concludes with a summary of the themes discovered. It is interesting to note that no artifact data or interview data showed suggestions of skills being decreased or increased. Only positive perceptions were described by all artifact data and all interview data.

Table 2.

Five Themes in This Study

Themes	Self-efficacy
	Problem solving
	Emotional control
	Achievement
	leadership

Theme 1: Self-awareness. The theme function helps support the research question because it offers insight into the participants' perceptions of their lives, specifically in their work environments. Each theme is supported by multiple codes that are discussed using participants' perspectives below. The theme self-awareness, problem solving, and emotional control supported the research question, while the themes achievement and leadership did not directly support. These other themes provided insight into the possible implications of increased self-awareness, though this researcher did not study cause and effect.

Self-awareness is supported by codes such as confidence, belief in future, belief in abilities, creating future plans, risk taking, self-care, effort, self-advocate, clarity, and motivation. Other codes that supported this theme include quality of life, quality of work, determination, happiness, commitment, ownership, expression, and handling setbacks. Participants' voices supported these codes, as demonstrated below. When asked about having the abilities to achieve a goal, Henry stated, "I didn't really emphasize which program I wanted to get into, but after Learning RX, I made the goal, "Okay. I wanna get into these top programs. These are my goals." I kept striving and kept pushing. I knew that I had to do the GRE and I had to get these certain amount of grades. I guess the quality that I probably had in doing that was my grit, my discipline and resiliency to

always make sure I was on top of my work. But once I finally got into those programs, my goal now is to graduate, pass boards, and get a great job in a field that I know I'm actually making a difference and not just, pushing papers and pushing numbers, and trying to see a lot of people even though I might not need to. I just wanna get out in the workforce, I guess."

Another participant, Lee, discussed his ability to achieve goals he has set for himself. "I guess I've become a very goal-oriented person in that I'm not like goal oriented to the point of like that's all I see, that's not what I, that's not exactly what it is, but it's definitely like a guiding light for me. If I'm ever confused, I go back to what the goal was, you know. It's just a guide." Prior to this program, this participant was not sure how to achieve his goals and struggled in his day to day activities. One example of this was how he would approach studying. The artifact data showed many participants stating phrases such as the, "cycle is broken," "believes in her brain," and "shows no more desperation." These statements show a belief in self, part of the definition of self-efficacy. One participant even reported that after their program it was, "like a weight lifted off:"

I could drill myself with flashcards over and over again and I could [inaudible 00:04:48] very well on the flashcards, and then 20 minutes later, like forget about it. I couldn't, it's like I never drilled myself. So that's what I felt it was initially. Then as the training went on, one thing you noticed was, like I had the ability, like remembering things wasn't really the problem, it was ... I could remember things. I could remember things. These were a matter of access. You know knowing how to access memory.

Confidence was a code repeated several times throughout the artifact data. This confidence was shown in one artifact as a reduction of “nausea” before a show performance occurred. Participants throughout the artifact data also reported this confidence by declaring, “good enough now,” and they no longer need to say, “I don't know what I am doing." The reductions did not stop at those statements. Participants also reported reduction in some feelings. These reductions were in the form of “not feeling stupid,” “not feeling lost,” and “not afraid of math anymore.” These types of phrases were not used as widely throughout the interview data. This was further supported during the member checking interviews when participants articulated they could express themselves better and more easily when they were in stressful situations.

Belief in the participants’ abilities and a belief in the future were both codes that had direct connections to the definition stated above for self-efficacy. Belief in their abilities was expressed by participants in ways such as, “I’m smart enough”, “I have enough ability to be a normal person instead of seclude myself”, “I no longer felt like I wasn't smart enough to be a student,” and “I know that I can connect with these people who are higher up in their field”. Participants gave examples to support this by explaining what abilities they have that would help them achieve at a higher level in their work while showing they enjoyed this new feeling of believing they can achieve. One participant stated, “it was so good to know that I can do it” while another showed tenacity by stating, “I knew I had no choice but to get 'em done or else I'd be sent back.” Another even showed some perseverance to tasks by saying, “you just gotta power through it” when it pertains to setbacks in life.

Another code that directly supports self-awareness is belief in the future. This was interesting because most participants stated in their interviews that they were not sure what their futures had in store for them prior to beginning their programs. “I believe that I don't have any limits” was the quote that stood out most for the researcher because it was such a sense of pride for this participant. All participants spoke of jobs, positions, tasks, or activities they wanted to pursue in the future. Some of these were police officer, researcher, Doctor, Master’s degree, and learning about the brain. Ruth even said, “I just want to live,” “I’ll be independent,” and “I have a bucket list.” For Ruth, this was quite a change from the struggles she was having prior to her LearningRx program. Words such as, “hopeful,” “happy,” “confident,” “wonderful,” and “success” were used to describe the future. Overall, these participants felt confident they had bright futures ahead and would be able to achieve whatever they chose.

Theme 2: Problem solving. Problem solving was also pervasive among the participants. Problem solving is one’s ability to identify a problem, decide if the problem is worth tackling, discover logical steps to solve the problem, and then take the steps necessary to solve the problem. Problem solving can sometimes be seen as a daunting task by both adults and children. Adults who struggle will often shy away from problems because they are overwhelmed by the task or just do not want to emotionally engage in that task. The participants in this study did speak about not tackling problems well or even avoiding problems prior to their LearningRx program. Because adults sometimes either avoid a problem or do not have the skills to take on a problem, this can lead to lower self confidence. Lower self confidence can often make a person make mistakes because the steps are too complicated. These same adults do not always see all of the

steps involved in solving a problem. Adults who are able to solve problems easily, quickly, and have a plan can increase their confidence.

Codes that supported this theme were: logical connections, goal setting, preparation, organization, realistic expectations, decluttering, task completion, and time management. Others that supported this theme were: communication, decision making, strategic thinking, details, mental calculations, choices, procrastination, and task switching. Interestingly, participants spoke both about the processes they use to be better at solving problems and the ability to communicate their thinking and their answers. First, participants spoke of setting goals. Lee stated, “The process instead of the end goal is probably the most important thing for me.” Lee also stated, “sometimes, as I look at those goals, I look at what's involved in achieving those goals, I ask myself how I can keep it simple.” Another participant stated, “I set very clear goals about what I want to achieve in those things.” Some even explained their actual processes of achieving their goals. Ruth illustrated her abilities to now declutter her life, including her car and desk.

Surprisingly, the idea of clutter or inability to organize was something several of the participants mentioned. This inability to organize or the overwhelming clutter could be something that clouded the ability to solve problems. When one cannot even organize themselves, it may be more difficult to organize steps to solve a problem. This is something that Ruth struggled with prior to her program. I am always of throwing papers or articles, or anything away. The first thing was my car. would set everything down in the passenger seat. It wasn't just six inches, it got to 12 inches, and so forth. I wanted to get rid of that. If you notice right now, I came in this morning, my desk is clean. Before, I had papers around where, I knew where everything was. But the appearance was that I

looked scatterbrained. Many times, now at night, I write down everything I want to accomplish the next day.

This organization that was reported by Ruth was also seen in the artifact data. Many participants used phrases such as, “tracking everything” now, “staring on top of stuff,” “better using planner,” and even “cleaning room is organized”. When speaking about solving problems specifically, phrases such as “keep striving and kept pushing,” “always try to plan five or 10 years ahead,” “it's definitely like a guiding light for me,” and “I was standing, holding my own” were used. The artifact data showed an increase in the use of logic through the “ability to keep things straight,” “making connections,” “understanding instructions,” and “better able to analyze information.” These are all components that make solving a problem easier, whether it is a life or academic problem. During member checking interviews, the handling of stressful situations was met with the ability to plan and prioritize and do these efficiently. Lee articulated he feels things, “just move a lot faster and more efficiently” so he can “identify, prioritize very well.”

Theme 3: Emotional control. Emotional control came in many forms during the interviews and throughout the artifact data. Emotional control is the ability to control both high and low emotions, choosing the appropriate emotional reaction, and having emotions a person did not feel before. Some people were not emotionally connected to friends and family prior to their LearningRx program and now are working to build these connections. Sometimes having the appropriate emotional response in a situation may not happen because a person feels overwhelmed with their surroundings or has too much occurring at once. When this happens, they may lash out when another person asks a question or expects a quick response. After this inappropriate reaction, there may or may

not be feelings of regret because these emotions were not recognized. This theme also encompasses the ability to communicate with others and be independent. Communication is important from an emotional perspective because adults who communicate can built a connection with others. Within this emotional control comes the feelings of patience and maturity.

The theme emotional control encompassed codes such as stress, reflective, self-control, attitude, communication, independence, boundaries, and positivity. Also included as codes under this theme are enjoyment, maturity, patience, enthusiasm, and gratitude. When participants spoke of having control of their emotions, they spoke in a reflective tone. They seemed to get choked up about this when they spoke about how they can handle conflict, attack problems, enjoy life, and face their futures. All interview participants stated they felt their confidence had increased since their LearningRx program. Lee detailed this when he talked about how he stands up to bullies in his life. He said, “you're not going to bully me. You're not going to tell me I'm done, and you can walk over me.” This assertiveness was shown in the artifact data with reports of “better advocating for himself” and being “more assertive with teacher.” This also shows a willingness to be an advocate for himself.

Sarah said she attacked a problem by telling herself, “why sit here like panicking, when I really did have a lot of knowledge that I could solve for it.” Scott said, “I'm not afraid to ask for help anymore” when asked about solving problems. He indicated he wanted to be noticed by instructors now when he used to hide in school and hope no one would call on him. Tina described her approach to success by saying:

I'm so far ahead of everybody else who always told me I was going to be so far behind. For me, deep down, even to other people it doesn't seem like a big deal, but for me, it's a really big deal to me to know that I did it and it was just me. It didn't have anything to do with anybody else really. It was me.

She felt she has achieved in many ways, such as living on her own, taking care of her daily needs, and being in college. She said that people, including her parents, used to doubt her abilities to achieve, but now she is, "standing, holding my own." Lee spoke about his confidence, stating, "I can tell you that I will get the job done. I can guarantee that much." Others mirrored that feeling with phrases such as, "you can tell me I'm not going to do it, but watch me do it," "not second guessing myself," and "I do feel like my confidence has substantially increased." Every participant discussed being less stressed or feeling less anxious as they lived their lives. When Tina discussed taking her assessments in college, she said she would have panicked before her program, but now she stays calm and tells herself, "I'm just going to like do this test." Sarah also spoke of schooling and said, "I didn't fully stress over the grades that much" when she discussed the end of her semester. Another participant also expressed that his "nerves, my anxiety have decreased." Member checking interviews further supported emotional control through the participants' abilities to be able to express themselves effectively and recognize when stressful situations arise.

While considering their stress levels, participants were reflective. Tina said she knows herself, "to the point where I know that would have been a slippery slope" had she not completed a LearningRx program, though she did not want to participate when her parents took her to do her initial assessment. Artifact data brings happiness of participants

into focus by presenting reports of “having more fun,” “a lot happier,” “smiling more,” and one participant even reported their “face lights up talking about LearningRx.” This is echoed in the feelings of gratitude and enjoyment in life. Participants are “finding joy in music,” “enthusiasm for work,” and saying, “enjoys life again.” These phrases were repeated by several participants throughout the data.

Theme 4: Achievement. Achievement can be academic, in the workplace, an increase in memory, or even a perception of feeling more accomplished. Achievemtn academically does not just have to occur within the academic setting, but can be an increased ability to comprehend what is read or being able to do mental math problems more quickly and easily. Achievment within the workplace could be characterized as a promotion, meeting a goal, or getting good ratings on an evaluation. These acadmic skill increases can certainly play a role in workplace achievement because an adult needs to have the skills necessary to do their job. Memory skills decrease as we age but are so important in life. People want to remember family, events, grocery lists, a to do list, tasks at work, and stay focused without being distracted. Participants spoke often about increases in their memory. They often equated this increase to more confidence. Achievement is not something that was sought in this research but it is interesting that all six interview participants spoke about the feeling of achieving more in their personal and work lives.

Achievement, theme 4, is comprised of codes that include: memory, educational achievement, focus, processing speed, comprehension, time management, and efficiency. Codes also included: cleanliness, medication, driving, visual processing, and work performance. This theme did not directly support the research question; however, future

researchers might examine if this theme is a byproduct of increased self-efficacy. Self-efficacy is defined in this research as a belief in the ability to achieve, but not necessarily to attain results. Further exploration is needed to see if this connection is supported. This theme provides some interesting information from the collected data.

While participants spoke about specific improvements in tasks such as test taking, driving, comprehension, and memory, they also spoke of improved efficiency and time management. The question was not asked directly if these areas of both personal and work lives were perceived as being improved. These specific improvements included, “I was starting to retain things on my own,” and “anything people tell me, I've got it” from Ruth. Ruth gave a specific example of both her home and car being organized having an effect on other parts of her life: “It's a very methodical thing, which is giving me more time to do some of the thing I love.” Achievement was the most widely supported theme in the artifact data, focusing specifically on different types of academic achievement. These academic areas included reading, math, writing, test taking, and comprehension. One participant from the artifact data stated they do “not record lectures anymore” because they understand the material better and are, “absorbing info in real time.”

Ruth and Scott were the only interview participants who did note that they were able to stop or reduce the use of medication. Scott was able to completely stop taking his medications for his attention deficit hyperactivity disorder. He had been on medications for several years and midway through his program was able to stop taking the pills. This is definitely a place where further research could be conducted to see if there is a direct correlation between this program and medication usage. Though the question was not

asked directly, both Ruth and Scott felt this was an area of achievement in their personal lives.

Each participant gave examples of other people noticing the changes and improvements in their lives. Tina said that, “they believe in me more” when speaking about her family. She also noted that, “when I talk to them, they look at me more as somebody who knows what they're doing instead of somebody that they have to guide to make decisions.” Scott believed his work peers saw these differences because, “I became a big asset to them.” Scott’s parents attended his graduation from Navy boot camp. When they attended this graduation, he, “could tell that they were proud of me and everything I just did and went through to become what I am right now.” This was particularly impactful because he struggled in high school and his parents had to remove him from general education so he could graduate. While some families and friends noticed improvements, Sarah was glad to see her family was, “less concerned in certain ways” because before her LearningRx program, they, “felt the need to remind me, don't forget your keys and now they don't think I'm as forgetful.” This is important to note because it shows some bad habits and poor abilities are believed to have subsided or even disappeared. These final two themes need further exploration to see if they can either affect self-efficacy or support self-efficacy.

Theme 5: Leadership. Leadership was not a theme this researcher expected to find. Leadership was defined as leading one’s self and others. This leadership can be found in the workplace, personal life, and in the community. Independence and responsibility for one’s self are important because this means a person does not have to rely on others to get things done around the house or the workplace. With independence

can often come a sense of accomplishment or excitement because things can be accomplished on your own. Whether it be moving out of your childhood home for the first time and being able to take care of yourself, or moving to another country on your own, this independence can help someone feel they aren't alone. When a person is thrust into a situation like this, they can feel isolated or feel overwhelmed at the thought of having to care for themselves. When one can care for themselves, they can also care for others. This leadership in external situations is often difficult because there can be a feeling that failure can occur. In this research, leadership is defined as leadership of yourself and others. One interesting discussion with participants came around professionalism in the workplace. Further research could be done focusing on this possible connection between professionalism and confidence in the workplace. In this current research, this theme did not have as much data supporting it as the other themes.

The final theme, leadership, included codes such as community involvement, helping others, professionalism, business planning, independence, and responsibility. This final theme also did not directly support the research question asked in this research. However, future researchers might ask if this increase in leadership is a result of the increased self-awareness, problem solving, and emotional control. Self-efficacy does not require leadership, nor does the definition state this is a result of increased self-efficacy. Again, though this theme did not answer the research question, the information gleaned from the data is interesting.

Ruth felt that her other new found abilities and organizational skills allowed her to have more time, "for things she loves" in the community. She does volunteer work in several community organizations and has been able to take leading roles in these

organizations. She is even the president in one of her local clubs. This has also allowed her to, “pull my team together, and say, we have this issue. I just need to have input" when she has a problem that needs to be solved. She would not have done that prior to her program. Sarah stepped up in her role as an assistant and, “in labs I take more of a leading role.” Tina felt she had been able to become independent and now lived, “in downtown LA by myself” and was, “responsible for making my own food, grocery shopping.” In the artifact data, participants reported being, “a leader” and, “better captain.” Six times, participants identified they had taken on more responsibility since their LearningRx program. This theme was only supported by eight codes but lends itself to further exploration in the future.

Summary

The purpose of this qualitative case study was to determine if self-efficacy perceptions improved for adults who completed a ThinkRx brain training program between 2015 and 2018 at a LearningRx center in [redacted]. The case study required the development of a research question, collecting data through artifacts and two types of interviews, coding the data using a thematic data analysis procedure, and interpreting results around the research question. The research site was one LearningRx Brain Training center in [redacted]. The artifact sample included 26 participants who completed a brain training program between 2015-2018. The interview sample included six participants who completed a brain training program between 2015-2018. The qualitative single case study design that was selected was most appropriate to understand the perceptions of the adults who completed a ThinkRx Brain Training program.

The data analysis procedures were modified to simplify and move to thematic analysis method instead of using Hatch's nine step thematic analysis. This was done to simplify the process and match what the research was actually doing during the reseach. The coding method was originally going to be the Values, Attitudes, and Beliefs coding method developed by Saldana (2012) but was changed to open coding. The V, A, B coding method gave no additional information to the researcher so was abandoned early on. The researcher felt the same information was being gained by simply using open coding as the method since the analysis was on the perceptions of adults.

Five themes emerged from the data: self-awareness, problem solving, emotional control, achievement, and leadership. The theme self-awareness supported the research question, which inquired about the self-efficacy perceptions of adult participants. The themes problem solving, emotional control, achievement, and leadership did not directly support the research question. However, some participants stated they would not be where they are today, with their other accomplishments, without having done their ThinkRx program. The study results supported the research question by showing perceptions of increased self-efficacy in the forms of belief in abilities, belief in a future, determination, perseverance, trusting in oneself, and determination.

The other themes emerged from the data, though they did not directly support the research question. These themes have value because they revealed that many participants perceived other benefits from their ThinkRx program. Some of the benefits that were perceived were increased ability to think quickly, be organized, have better decision-making skills, complete tasks, and communicate better, under the theme of problem solving. The theme of emotional control showed participants describing increased

abilities such as independence, less stress, less anxiety, not feeling overwhelmed, more enthusiasm, and more joy in life. Another theme, achievement, showed higher achievement at work, higher achievement in studies, overall skill increases, efficiency, and focus. The final theme, leadership, revealed perceptions such as increased community involvement, professionalism, responsibility, and business planning.

One limitation evidenced by this study was the small sample size. Because of the small size of the brain training center, only six people agreed to participate in the participant interviews. Having a larger sample size in a future study could offer additional perspectives from adults who have completed their ThinkRx brain training programs. This would also open up perspectives from different parts of the United States and offer a wider age range. This would also allow a researcher to consider if results could be generalized to a larger population. Another limitation of the research was not being able to speak with participants both before and after their programs. There could have been potential for the secondary data from the artifacts could contain social desirability bias where the participants answered what they thought the Program Director wanted to hear. This could not be controlled by the researcher because this is secondary data. Potential bias is also a limitation in qualitative research. Because this researcher is making decisions about inclusion or exclusion of data, this may cause interpretation of the data to be biased. Sampling bias could have played a factor in the results that were gained in this study because it is not known if the data that could have been gathered might have yielded different results

Chapter 5 includes a summary of this research study. The chapter includes discussion of topic significance and how this study adds to the existing literature on brain

training and self-efficacy. The chapter also contains conclusions and implications drawn from the research, as well as recommendations for future research.

Chapter 5: Summary, Conclusions, and Recommendations

Introduction and Summary of the Study

Self-efficacy perceptions of adults who completed a LearningRx ThinkRx Brain Training program were the focus of this research study. Self-efficacy is a person's belief in his or her abilities to achieve, specifically at work (Bandura, 1977, 2006, 2008, 2012). This belief is important because if people believe in themselves, they are more likely to achieve. Self-efficacy is a major component of a person's capability and performance in the work environment (Alessandri et al., 2015; Bandura, 1977; Bandura, 2012; Bates et al., 2013; Lunenburg, 2011). Without this belief, a person may begin to question, doubt, or even give up. Existing research revealed that brain training scholars have had mixed opinions of the transfer of cognitive changes to broad tasks in life and work (Folkerts, Roheger, Franklin, Middelstadt, & Kalbe, 2017; Noack, Lovden, & Schniedek, 2014). Though these changes have support in some research, there are some mixed results. The existing research on self-efficacy has shown that it plays a role in learning performance and motivation (Alessandri et al., 2015; Kim, Oh, Chiaburu, & Brown, 2012; Sander & Sander, 2003; Woo et al., 2014). Researchers have also recommended that further studies be conducted to explore the far and near transfer effects of brain training (Jedlicka, 2012, 2017; Ledbetter, Moore, & Mitchell, 2017).

The purpose of this qualitative case study was to determine the self-efficacy perceptions of adults who completed a ThinkRx brain training program between 2015 and 2018 at a LearningRx center in [redacted]. This research was a qualitative case study that used inductive analysis to examine the collected data. Self-efficacy is different from self-confidence or self-esteem. It is the deep belief in one's own abilities to

achieve in the workplace. This study was important because employers look for ways to encourage their employees to succeed, and employees look for ways to advance at work. If people believe in themselves and their abilities, there is a higher likelihood of their success.

This study used a qualitative single case study design to explore the perceptions of individuals after they have finished a brain training program (Yin, 2014). The phenomenon studied was the self-efficacy of adults in their workplace. Self-efficacy was defined by Bandura as a person's belief in his or her own abilities, specifically in work performance (Bandura, 1977, 2006, 2008, 2012). This study was an examination of self-efficacy in the participants' workplace lives. Self-efficacy is a predictor of workplace success; therefore, examining a possible way to increase self-efficacy could be useful for employers and employees alike. One research question drove this study. The data sources used in this study included artifact data, participant interviews, and member checking interviews. The data sources were appropriate to support the research question because they offered insight into the perceptions each brain training participant had right after their brain training was completed and their current perceptions.

This study added to the body of knowledge on brain training transfer effects and self-efficacy. The participants in this study were adults who completed brain training at a LearningRx Brain Training center in [redacted]. The results offered insight into the perceptions of these adults both right after their program and after some time has passed. Chapter 5 will provide conclusions, implications, and recommendations from this study.

Summary of Findings and Conclusion

This study explored the perceptions of adults who have completed a brain training program using the LearningRx ThinkRx program. The chosen methodology was a qualitative descriptive case study. One research question drove this study. Inductive analysis across the three data sources supported this question. Themes emerged from the artifacts, participant interviews, and member checking interviews. The results showed support for the question and offered additional insight about the perceptions of the brain training program. The results also offered recommendations for both employees and employers as to an alternative way to increase self-efficacy of employees. It also offered recommendations for future research on brain training, including possible additional research on the self-efficacy of children after training. The study adds to the body of knowledge by exploring the brain training perceptions from adults. The results can help inform adults about alternative ways to help them increase their self-efficacy at work. Findings are summarized below and organized by theme, followed by a summary of how the themes supported the research question.

Theme 1: Self awareness. This theme contained codes such as confidence, belief in future, belief in abilities, self-esteem, creating future plans, risk taking, trust in self, self-advocate, motivation, and school effort. Self-awareness was defined as the perception of one's ability to recognize, plan for, and attack a problem or situation.

Theme 2: Problem solving. The codes in this theme included: logical connections, organization, realistic expectations, task completion, time management, less anxiety, communication, decision making, strategic thinking, and mental calculations. Problem solving was defined as the perception of one's ability to recognize, plan for, and

attack a problem or situation. This includes being able to set goals for oneself, plan how those goals might be achieved, and execute the plan.

Theme 3: Emotional control. The third theme included codes such as less stress, reflective, self-control, attitude, communication, boundaries, positivity, enjoyment, maturity, patience, and relaxation. Emotional control was defined as the perception of one's ability to control reactions in situations, stay focused with emotions, and not to have large mood swings. This also includes the perception of being able to enter a situation without over reacting.

Theme 4: Achievement. The fourth theme included codes such as: memory, educational achievement, focus, seeing value in learning, things come easier, processing speed, comprehension, observant, efficiency, cleanliness, medication, driving, and visual processing. Achievement was defined as evidence of being able to achieve at higher levels than before in both the workplace, school, and life. This includes the academic setting, sports skills, and workplace skills.

Theme 5: Leadership. The final theme included codes such as: community involvement, helping others, professionalism, business planning, curiosity, independence, humor, and responsibility. Leadership was defined as the willingness to take on leadership positions or roles and the perception of showing leadership potential in actions and words.

The research question asked how adults who completed a ThinkRx brain training program perceive their workplace self-efficacy. The research question was supported by the themes self-awareness, problem solving, and emotional control. The participants reflected on their perceptions of any changes or improvements in their work life. They

also reflected on the reasons they first chose to attend a LearningRx program. They identified their initial struggles and improvements in their lives currently.

The research question that drove this research study aligned with the conceptual framework described below. This study was framed using Bandura's self-efficacy, Gottfredson's causal model of cognitive ability and job performance and the Cattell-Horn-Carroll theory of intelligence (Bandura, 2012; Flanagan & Dixon, 2014; Gottfredson, 1997; Hoelzle, 2008; Schmidt, Hunter, & Outerbridge, 1986; Schneider & McGrew, 2012). The results supported this understanding of self-efficacy through multiple codes discovered in the data collected. Participants reported improvements in their belief in themselves, their abilities, and their futures. The results also supported Gottfredson's causal model of cognitive ability and job performance through the perceptions of improved work and life performance. The participants often stated they felt their overall cognitive skill sets had improved. The interview participants did report both life and work improvements.

The results supported the existing literature because they showed participants reflected on their belief in their abilities to achieve. This directly supports the research on adult self-efficacy. The interesting information found in this study was participants reporting both the belief they could achieve, but also improved achievement. They also reported they were taking on leadership roles and responsibilities. Several researchers unearthed the benefits of brain training with children, but also adults. Most studies focused on the effects of brain training with children. This study revealed that participants felt they could problem solve better and more efficiently and they have better control of their emotions. This research study not only supported findings from existing

research, but it also added to the existing literature by showing participants also felt they have achieved since their LearningRx programs and have taken on more leadership opportunities. These perceptions should be explored more in future research.

Implications

Several implications resulted from this research study. The purpose of this qualitative single descriptive case study was to explore the perceptions of adults who completed a LearningRx brain training program and their perceptions of their self-efficacy. The study implications were categorized as theoretical implications, practical implications, and future implications. Strengths and weaknesses of the study have also been identified.

Theoretical implications. The study was framed by the theory of self-efficacy developed by Bandura. Bandura defined self-efficacy as a person's belief they can achieve, specifically in the workplace setting (Bandura, 2012). The results of this study supported this understanding of self-efficacy because the participants reported belief in their own abilities, their futures, and themselves. The participants also considered the implications of their beliefs by reflecting on the many achievements they have had in school, life, and work. The study results also supported Gottfredson's (1997) causal model of cognitive ability and job performance. This theory states that increased cognitive abilities have a correlation to increased job performance. Though this study did not directly measure or compare cognitive abilities in the participants, it supported this theory because each of the participants perceived they had improved their abilities. By improving their abilities, they felt their performance had improved.

Practical implications. Practical implications exist for people who want to improve their workplace performance. The LearningRx program studied in this research could be a viable intervention for adults wanting to improve their performance at work. It could also be an intervention companies can implement within their businesses. This program shows promise as a potential retention tool for employers. With improved performance and improved belief in themselves, a worker might feel more satisfaction in their job. This increased satisfaction could be a way to increase the longevity of employment.

Future implications. A future implication from this study is for adults to consider brain training as an option for increasing their self-efficacy in the workplace. Adults and employers alike can use brain training as a viable option for empowering workers to improve in the workplace and seek out ways to improve. Most brain training research has focused on the increase of cognitive skills. This study suggests additional uses for brain training. With the additional findings of achievement and leadership as themes in this study, employers could explore this as an option for training future leaders. If employees fail or fall behind in their jobs, this could also be a viable training opportunity.

Strengths and weaknesses of the study. A strength of the study was the openness of each of the interview participants. They provided many examples to further explain their perceptions. This researcher sought to understand perceptions adults had after attending the LearningRx program. Previous researchers had not explored this topic with adults or with adults specifically about their workplace beliefs. The results and implications of this research can be useful to further explore the impact of self-efficacy

on both leadership and achievement. The conclusions in this study can be considered credible, given the suitability of the methodology and research design selected, the meticulousness of the data analysis procedures followed, and comprehensive report of results.

The following points were identified as limitations of the study:

1. The artifact and interviews were limited to one LearningRx location. Future research could be expanded by opening interviews and data collection to all centers across the United States.
2. All interviews were not conducted in the same manner. This could be a limitation because all participants did not have the same setting in which to interview.
3. Some interviews were collected by phone, so this limitation did not allow the researcher to read body language while interviewing.
4. One interview was collected in a different setting to make the interview participant more comfortable. However, this is a limitation because the interview conditions were not identical.
5. Because the artifact data were pre-existing, the researcher was not able to return to each participant to ask clarifying questions. This could have affected the way the researcher interpreted data.
6. Purposeful sampling may have limited the amount of data collected. This also limited the ability to generalize the data to a larger population.
7. Sample size may be small so the data might have been limited.
8. Social desirability bias could have played a role during the collection of the artifact data.
9. The researcher had no control of the artifact data collection since it was collected by the Program Director. There is no guarantee of accuracy.
10. No observations were conducted as a check to see if the perceptions of the participants actually transferred to real life.

While limitations existed in the study, the results still offered significant implications and contributions to existing literature. Implications of this study supported the theoretical works of Bandura (1977) and Gottfredson (1997). The participants in this

study expressed open and honest perceptions of the changes in their lives since completing a brain training program. They each expressed improvements in their self-efficacy and their work performance. This study also supported the social cognitive theory of Bandura (2012). This theory states that people exert intentional influence on their lives and the course of future events. The participants in this study believed they had an impact on their future. Practical implications exist in the future for adults who want to improve their own beliefs in their abilities, problem solving, and emotional control. Practical implications also exist for employers who want to assist employees in their improvement, which, in turn could help the business grow. This could be an economic decision for employers because of the causal model of cognitive ability and job performance. Schmidt, Hunter, and Outerbridge (1986) indicated people perform at higher rates when they have higher cognitive abilities. If employees were to participate in a brain training program to increase their skill set, this could potentially have an impact on the business.

Conclusions in this study can be considered credible, given the suitability of the methodology and research design selected, the meticulousness of the data analysis procedures followed, and comprehensive report of results. The researcher ensured this by working with the committee chair several times per week on the analysis and data. The researcher also used reflexivity by taking copious notes during the process in a journal and reflecting on the information contained in the journal throughout the process.

Recommendations

The literature review for this study uncovered the need to further understand the way adults perceive their lives since participating in a LearningRx brain training

program. This study informed recommendations for future research and future practice. These recommendations are described below.

Recommendations for future research. The following recommendations are provided for future researchers.

1. This research focused on a single case study with participants from one LearningRx location. Future research could be done using data from several LearningRx locations across the United States.

2. Future research could explore the possible connection between self-efficacy and actual achievement in the workplace by examining employee evaluation reports.

3. Future research could explore perceptions and possible effects of self-efficacy and leadership by following the careers of entry level employees to see if an increase in self-efficacy has long term effect on leadership. Another possibility for this research would be to track leadership opportunities.

4. One additional opportunity for research would be to examine self-awareness. This surfaced as the prevailing code across all forms of data studied. Future research could study the connection between self-efficacy and self-awareness.

Recommendations for future practice. Professionals in the field of human resources may benefit from reading and implementing results from this study. Workplace coaches and employees alike can benefit from reading and implementing results. Two recommendations for future practice have been identified from this research.

1. This research revealed that adults perceive their self-efficacy increased as a result of participating in a LearningRx brain training program. This program could be a possible intervention for employees who want to advance their career or improve in their current positions.

2. This research also revealed that perceptions of increased problem solving skills and emotional control were expressed by adults who completed this program. This program could be explored as an opportunity for adults who need additional assistance in these areas.

Conclusion

This qualitative, single descriptive case study explored perceptions about self-efficacy by adults who completed a one-on-one LearningRx program. The theoretical framework included Bandura's theory of workplace self-efficacy and his social cognition theory. The theoretical framework also included Gottfredson's theory of the causal model of cognitive ability and job performance. Data sources included 26 pieces of artifact data and over 100 pages of transcripts from participant interviews. Also included in these data were four additional member checking interviews.

Thematic analysis revealed five themes: self-awareness, problem solving, emotional control, achievement, and leadership. Findings revealed that participants perceived improvements in their overall self-efficacy not only in the workplace, but in life. Through their perceptions and conversations, participants uncovered improvements in their ability to problem solve and control their emotions. All participants gave rich examples of the changes in their lives. Additional perceptions included changes in their achievement and taking on additional leadership opportunities.

Theoretical implications, practical implications, and future implications related to the results of this study exist. Recommendations for future research could reveal additional connections between brain training and leadership or problem solving. Recommendations for future practice could provide opportunities for improvement programs and interventions for employees.

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Appendix A.

Site Authorization Letters

Site authorization letters on file at GCU

Appendix B.

IRB Approval Letter

3300 West Camelback Road, Phoenix Arizona 85017 602.639.7500 Toll Free 800.800.9776 www.gcu.edu

DATE:	December 06, 2018
TO:	Sue Ann Highland
FROM:	Grand Canyon University Institutional Review Board
STUDY TITLE:	Examining the Self-Efficacy Perceptions of Adults Who Completed a ThinkRx One-on-one Brain Training Program
IRB REFERENCE #:	IRB-2018-595
SUBMISSION TYPE:	Submission Response for Initial Review Submission Packet
ACTION:	APPROVED
APPROVAL DATE:	December 06, 2018
EXPIRATION DATE:	
REVIEW TYPE:	Expedited
REVIEW CATEGORY:	Category 7

Thank you for your submission of New Project materials for this research study. Grand Canyon
University Institutional Review Board has APPROVED your submission. This approval is based
on an appropriate risk/benefit ratio and a study design wherein the risks have been minimized.
All research must be conducted in accordance with this approved submission.

This submission has received Expedited Review based on the applicable federal regulation.

Please remember that informed consent is a process beginning with a description of the study and

insurance of participant understanding followed by a signed consent form. Informed consent must
continue throughout the study via a dialogue between the researcher and research participant.
Federal regulations require each participant receive a copy of the signed consent document.
If applicable, please use the approved informed consent that is included in your published documents.

Please note that any revision to previously approved materials or the data collection protocol must
be approved by this office prior to initiation. Please use the appropriate modification request form.

All SERIOUS and UNEXPECTED adverse events must be reported to this office. Please use the
appropriate adverse event forms for this procedure. All FDA and sponsor reporting requirements
should also be followed.

Please report all NON-COMPLIANCE issues or COMPLAINTS regarding this study to this office.

Please note that all research records must be retained for a minimum of three years.

Based on the risks, this project requires Continuing Review by this office on an annual basis.
Please use the appropriate renewal forms for this procedure.

If you have any questions, please contact the IRB office at irb@gcu.edu or 602-639-7804.
Please include your study title and reference number in all correspondence with this office.

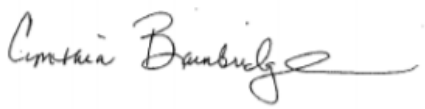
ADVANCEMENT TO CANDIDACY

Congratulations!

On behalf of the College of Doctoral Studies, we are pleased to inform you that you have now advanced to the Candidacy stage of your Doctoral journey. This means you have completed all of the required proposal phases of the dissertation and you are now ready to move into the research portion of the dissertation work.

This is an important step in the doctoral process. Through advancing to candidacy, you are now among an elite group of learners who are doing academic research. This also means you are representing yourself and Grand Canyon University as an independent doctoral researcher and with that comes a great deal of responsibility. We wish you the best in your endeavors! Congratulations on this important step in your doctoral journey and welcome to Candidacy!

Dr. Michael Berger
Dean, College of Doctoral Studies



Dr. Cynthia Bainbridge
Assistant Dean, Research and Dissertations Director, Institutional Review Board College of Doctoral Studies

Appendix C.

Informed Consent

INFORMED CONSENT FORM

Examining the Self-Efficacy Perceptions of Adults Who Completed a ThinkRx One-on-one Brain Training Program

INTRODUCTION

The purposes of this form are to provide you information that may affect your decision as to whether or not to participate in this research and to record the consent of those who agree to be involved in the study.

RESEARCH

Sue Ann Highland, student, Grand Canyon University, has invited you to participate in a research study. I am completing this research as part of my doctoral degree.

STUDY PURPOSE

The purpose of the research is to understand your perceptions of the LearningRx Brain Training program. This adds value by exploring how brain training affects the lives of adults.

ELIGIBILITY

You are eligible to participate in this research if you:

1. Finished a LearningRx program between 2015 and 2018
2. Did brain training in [redacted]

You are not eligible to participate in this research if you:

1. Did not finish a LearningRx program between 2015 and 2018
2. Did not do brain training in [redacted]
3. Under the age of 18

DESCRIPTION OF RESEARCH ACTIVITY

If you decide to participate, then as a study participant you will be asked to:

1. Join a 45 minute to 90 minutes interview
2. Interview at the [redacted] LearningRx
3. Possibly do a second interview for added questions
4. You may skip any questions

Approximately 8-10 people will be asked to join this research study.

RISKS

If you decide to participate in this research study, then you may face some risks such as: You may feel like you do not want to answer some questions during the interview. There are no other known risks from joining this study.

To lower the impact of these risks, you can:

- Skip questions in the interview
- Stop your involvement at any time
- Not join the follow-up interview

BENEFITS

If you decide to participate direct benefits to you are: Reflection about your LearningRx program

If you decide to participate indirect benefits to you are:

- Others may benefit by hearing about brain training
- This will contribute to research about brain training

CONFIDENTIALITY

All information obtained in this study is strictly confidential unless disclosure is required by law. The results of this research study may be used in reports, presentations, and publications, but the researchers will not identify you. To maintain confidentiality of your records, Sue Ann Highland will identify each person with a false name. Only the researcher and the dissertation committee at GCU will have access to raw data, including recordings. The audio tapes of the research interviews will be destroyed. This will happen three years after the dissertation is published. These will be destroyed by using a data destruction program.

The people who will have access to your information are: myself and my dissertation committee

Audio recording: I would like to use a tape recorder to record your responses. You can still participate if you do not wish to be recorded. Your identity will be protected by scrambling your information. I will do this on my personal computer at home.

I will secure your information with these steps:

- Locking the computer files with a password
- Locking any written notes in a filing cabinet
- Scrambling recorded files on my computer

I will keep your data for 3 years. Then, I will delete electronic data. I will destroy paper data using a paper shredder.

WITHDRAWAL PRIVILEGE

It is okay for you to decline to participate in this research study. Even if you say yes now, you are free to say no later, and stop participating at any time, there will be no penalty to you.

If you decide to stop participation, you may do so by: asking to stop verbally, asking to stop in writing, or in person. If you stop, I will use the partial information I collected from you.

Your decision will not affect your relationship with Grand Canyon University or otherwise cause a loss of benefits to which you might otherwise be entitled.

COSTS AND PAYMENTS

There is no cost to you as a participant in this study. There is no payment for your participation.

COMPENSATION FOR ILLNESS AND INJURY

If you agree to participate in the study, then your consent does not waive any of your legal rights. However, no funds have been set aside to give you in case of injury.

VOLUNTARY CONSENT

Any questions you have concerning the research study or your participation in the study, before or after your consent, will be answered by Sue Ann Highland, SHighland@my.gcu.edu, [redacted].

If you have questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the College of Doctoral Studies at IRB@gcu.edu; (602) 639-7804.

This form explains the nature, demands, benefits and any risk of the research study. By signing this form you agree knowingly to assume any risks involved. Remember, your participation is voluntary. You may choose not to participate or to withdraw your consent and discontinue participation at any time without penalty or loss of benefit. In signing this consent form, you are not waiving any legal claims, rights, or remedies. A copy of this consent form will be given (offered) to you.

Your signature below indicates that you consent to participate in the above study.

Subject's Signature	Printed Name	Date
_____	_____	_____
Other Signature (if appropriate)	Printed Name	Date

INVESTIGATOR'S STATEMENT

"I certify that I have explained to the above individual the nature and purpose, the potential benefits and possible risks associated with participation in this research study, have answered any questions that have been raised, and have witnessed the above signature. These elements of Informed Consent conform to the Assurance given by Grand Canyon University to the Office for Human Research Protections to protect the rights of human subjects. I have provided (offered) the subject/participant a copy of this signed consent document."

Your signature indicates that you have ensured the participant has read, understood, and has had the opportunity to ask questions regarding their participation.

Signature of Investigator_____

Date_____

Appendix D.

Recruitment Email

I am a graduate learner under the direction of Dissertation Chair Dr. Heather Miller in the College of Doctoral Study at Grand Canyon University. I am conducting a research study to the perception adults have after they finish a LearningRx brain training program. Participants must be over the age of 18 to be included in this study and must have completed their entire LearningRx program. You must have also completed your program in 2015, 2016, 2017, or 2018.

I am looking for adults who completed a LearningRx program (between 2015 and 2018) to participate in an interview, which will take approximately 45 minutes to 1.5 hours. These interviews will take place in the [redacted] LearningRx center at [redacted]. Adults will be audio taped so I can analyze the statements described by the participants. Tapes will be erased after a period of three years.

Your participation in this study is voluntary and there is no financial compensation for participating. If you have any questions regarding research study, please call me at [redacted] or email at SHighland@my.gcu.edu.

Sue Ann Highland

Appendix E.

Artifact Data

Final Post-training exit artifact

The post-training exit artifact is completed after the program is completed. The questions in the document are asked of all clients during the exit process and improvements are discussed.

Discussion Topics on the exit artifact are as follows:

- Review improvements noticed by your trainer: “Top Ten” Improvements
- Review of improvements noticed by your family
- Review “Proud of You Letter”
- Review test results (pre to post test results)
- Action Plan: What can you do to apply your improvements in your life.
- Next program recommendations

Follow-up assessment planned for one year from exit interview

Appendix F.

Interview Protocols and Questions

Protocol for interview (Stake, 1995, 2005, 2006; Yin, 1981, 2011, 2018)

1. Establish Rapport - Introduce myself, explain the research and get informed consent.
2. Point out the recording device to the participant and make sure it is working.
3. Establish purpose and motivation for study.
4. Give a timeline for the interview. This interview will be conducted either in face or on the phone and will last approximately 45 minutes to 1.5 hours.
5. Allow flexibility for dialogue

Interview Guidelines for flexible dialogue (Yin, 1981, 2011, 2018):

1. Comfortable setting, relaxed conversational voice and posture
2. Use probing questions
3. Try not to interrupt; make notes and come back to the idea later.
4. If a participant gives an answer related to another question not asked yet, record the answer and avoid repeating the question later.
5. Keep the conversation focused.
6. If time permits, ask the participant if there is anything else they'd like to share.

Research Question: What are the perceptions regarding self-efficacy and workplace concerns after completion of a ThinkRx brain training program?

Opening

A. (Establish Rapport)

My name is Sue Ann Highland. I am a doctoral learner at Grand Canyon University, doing a study on adults who have completed a LearningRx Brain Training program.

B. (Purpose)

I would like to ask you some questions about your experiences after your LearningRx program in order to learn more about you and share these results in my study. I want to help others learn about self-efficacy.

C. (Motivation)

I hope to use this information to help me get to know you better and use this to help others learn about LearningRx.

D. (Time Line) The interview should take about 30-90 minutes.

E. Demographic Questions

1. What is your name?
2. How old are you?
3. How old were you when you did your LeaningRx program?

Interview Questions – All questions answer the research question.

1. Why did you come to LearningRx?
2. Why did you choose LearningRx over other brain training programs?
3. Please describe any challenges you had before your program.
4. Describe your life since your LearningRx program?
5. What are your feelings about your life right now?
6. How do you define success?
7. Describe your abilities to accomplish goals. Give an example.
8. Describe a typical work day for me?
9. Describe how you fit into your work environment?
10. Since finishing cognitive training, describe how you confront problems and generate solutions at work. Give an example.

Appendix G.

LearningRx Program Information

The LearningRx program begins with an evaluation of the client's current skill set, using a cognitive skills assessment, and both life and work concerns (LearningRx, 2015). The Center Director or owner conduct a semistructured intake discussion to find out both the current concerns and the desired goals for the ThinkRx program. The Program Director will then communicate this information to the brain trainer so they can begin indidualized training. During each training session, which lasts between 60 and 90 minutes, the trainers records training session notes that are focused on improvements, mini-goals, and transfer of skills. It is important for the trainer to record this information so programmatic adjustments can be made to meet the needs of the client.

When training in the ThinkRx program, the trainer begins by setting the groundrules for positive interaction during sessions (Gibson et al., 2015; LearningRx, 2015). These three life lessons are no negative talk, it is okay to fail, and anything worthwhile takes hard work. These three life lessons are based on Bandura's theory of self-efficacy (Bandura, 1977; Bandura, 2012). Standard tools are utilized throughout a LearningRx program such as a timer and metronome (LearningRx, 2015). These tools are designed to train specifically in processing speed and increase attention. This program focuses on focused attention, divided attention, and sustained attention. During the training sessions, the trainer is providing both mental activities and distractions to assist in increasing these skills.

Some examples of procedures delivered during the ThinkRx program are Memory Match, Attention Speed, and Visual List (Gibson et al., 2015; LearningRx, 2015). The

Memory Match procedure is designed to increase visual memory, visual processing, and processing speed. The cards, as seen in Figure 14, are placed randomly into six squares by the brain trainer. After the trainer covers their board, the client counts aloud and arranges his cards onto his board in the identical pattern. This pattern is not reflective, but identical.

Figure G1. Memory match ThinkRx procedure.

The Attention Speed procedure trains processing speed, visual processing, saccadic fixation, and working memory (Gibson et al., 2015; LearningRx, 2015). The client is presented with a grid of 144 letters (p, d, b, q) on which they are told to make marks, as seen in Figure 15.The trainer gives the specific directions such as circle the p's and cross out the d's. This procedure is done on a beat or racing a timer.

Figure G2. Attention speed ThinkRx procedure.

Finally, the Visual List procedure is one that targets processing speed, visual memory, visual processing, short-term memory, and long-term memory (Gibson et al., 2015; LearningRx, 2015). This procedure begins with the client learning all of the Presidents of the United States, Figure 16. The trainer presents a story that represents the pictures of each President. Each picture is connected to the one before in a unique and novel way so it engages the brain more actively. The brain is more likely to remember this type of connection over a list of words. The client recalls this list of Presidents both forward and backward very quickly, typically under 40 seconds. Higher levels of this procedure requires the client to memorize random lists of words utilizing this connection strategy. However, the client creates the visual connections in their own head without prompting from the trainer.

Figure G3. Visual ist—Presidents—ThinkRx procedure.

Throughout the program, the Program Director conducts periodic progress checks with the client to monitor goals. Once the ThinkRx program is complete, the client is post-tested on the identical cognitive skills assessment to discover any improvements that occurred during the program. The Program Director then conducts a semistructured exit interview to review concerns from the beginning of the program, goals, changes, improvements, and transfer of skills to real life. During this exit interview, next steps are also discussed for the client such as future brain training and skills to practice to encourage continued real-life transfer of skills.

Appendix H.

LearningRx Learning Model

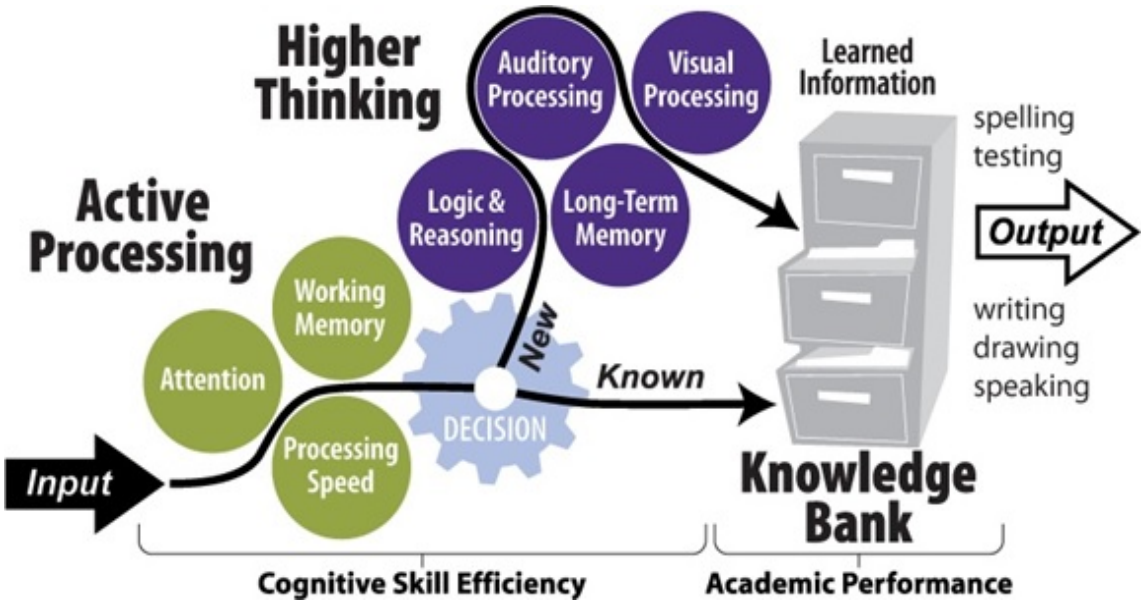


Figure H4. The LearningRx learning model based on the Cattell-Horn-Carroll theory of cognitive abilities.

Appendix I.

Inductive Analysis Process

1. All artifact data will be collected then analyzed using all of the following steps, beginning with step four.

2. Researcher conducted interview will be conducted.

3. All raw interview data will be sent to Rev.com for transcription.

4. I will read through all of the raw data from beginning to end.

5. I will then reread all data and identify frames of analysis. I will read through the transcripts the next time looking for ways to frame my analysis of the data. I will decide on how narrow to focus my analysis of all data gathered.

6. I will begin to create codes based on relationships within the data. This is the opportunity to develop a set of codes that have connections within these data.

7. I will then assign the codes within all data collected. During this step, some themes may be set aside because of their lack of connections within the data.

8. I will reread the data while keeping records of the relationships I find among codes.

9. During the prior step, I will need to decide which codes are not supported or examples that don't fit. During this step, I am looking for saturation of data.

10. I will know analysis within the codes is completed by looking for complexity, depth, and richness within a code.

11. I will continue to search for themes across codes and look for the same depth and richness.

12. An outline will then be developed that shows relationships both within and among the codes.

13. Excerpts of data will be chosen to support the relationships in step eight.

14. This process will be repeated for the member checking interview.

15. Once all three sets of data are analyzed, I will compare the outlines that were developed to search for themes across the sets.

Appendix J.

Coding Example

This document serves as an example of the value, attitude, belief coding process in the inductive analysis process.

V: (value) , A: (attitude), B: (belief)

Blog 1

[1] Dog training has changed a great deal in the past 25 years, and we now [2]know much more about how dogs learn and the [3]most effective ways to motivate them. While dog training in the past relied on being the [4]"alpha" in the relationship and required [5]equipment like correction collars (or choke collars), behavioral science proves that it's much [6]more effective to use positive reinforcement training, where [7]training is a team activity with both parties working together to achieve goals. [8]Positive-reinforcement is the methodology suggested by humane organizations, veterinary associations and dog trainers alike. This type of training [9]focuses on rewarding desired behaviors using something that the dog values (typically treats),[10] removing the reward for undesired behaviors and [11]not using physical punishment or [12]fear to bring about behavioral change.

[13]Clicker training is a wonderful way to utilize the power of positive reinforcement. The clicker, a small device that makes a precise noise, [14]effectively marks when your dog has performed the correct action that will [15]pay off with a food reward. Once your dog has mastered the behavior, you can [16]wean them off of the clicker and put it away until it's time to teach something new. Clicker training can be used for everything from [17]teaching the basics like "sit," "down" and "come" to more [18]complex behavioral modification for challenges like leash aggression.

Blog 2

Set up his private den. [19]He needs "a room of his own." From the [20]earliest possible moment give your pup or dog his own, private sleeping place that's not used by anyone else in the family, or another pet. [21]He'll benefit from short periods left alone in the comfort and safety of his den. [22]Reward him if he remains relaxed and quiet. His den, which is often a crate, will [23]also be a valuable tool for housetraining.

[24]Reward his good behavior. [25]Reward your puppy or dog's good behavior with positive reinforcement. *Use* [26]*treats*, [27]toys, [28]*love*, or [29]heaps of praise. Let [30]him know when's he's getting it right. Likewise, [31]never reward bad behavior; it'll only confuse him.

[32]End training sessions on a positive note. [33]Excellent boy! [34]Good job, Jasper! [35]He's worked hard to please you throughout the training. [36]Leave him with lots of praise, a [37]treat, [38]some petting, or [39]five minutes of play. [40]This guarantees he'll show up at his next class with his tail wagging—[41]ready to work!

Blog 3

While I do believe in positive reinforcement training, [42]I believe more in positive words and [43]gestures towards my dog [44]than dishing out treats. Trust me, [45]Sally still gets plenty of treats, but when we're focusing on training, I give her [46]confirmation by giving her affection and [47]saying "good girl." I also realize that every dog is different and while my [48]Sally didn't respond the best with treat training, she definitely took to training without treats. [49]Other dogs may have other needs. If you're looking to try training without treats, I've got some firsthand tips for you.

[50]Your dog should love you for more than just dispensing food to them. [51]Leaning on treats to grow your relationship with your dog can prevent the relationship from reaching a deeper, more meaningful level. When you call your dog's name, [52]they should come to you whether you have a treat in your hand or not.

Codes:

1. V: new understanding of dog behavior and needs
2. V: new understanding of dog behavior and needs
3. V: new understanding of dog behavior and needs
4. V: old understanding of dog behavior and needs
5. V: Negative behavior – equipment
6. A: positive behavior most effective method to train dogs
7. A: positive behavior
8. V: new understanding of dog behavior and needs
9. A: reward – food
10. A: consequences
11. V: negative reinforcement is bad
12. V: negative reinforcement is bad
13. A: positive reinforcement tool – clicker
14. B: positive reinforcement is most effective method
15. A: reward – food
16. B: positive reinforcement is most effective method
17. B: positive reinforcement is most effective method

18. B: positive reinforcement is most effective method
19. A: dogs need space
20. V: kennel training is valuable/important
21. V: kennel training is valuable/important
22. V: kennel rewards
23. B: kennel training is valuable/important
24. B: positive reinforcement is important / valuable
25. B: positive reinforcement is important / valuable
26. V: reward – food
27. V: reward – toy
28. V: reward – personal contact
29. V: reward – verbal
30. B: positive reinforcement is important / valuable
31. A: negative reinforcement not good
32. V: positive reinforcement
33. V: reward – verbal
34. V: reward – verbal
35. A: dog wants to do well
36. V: reward – verbal
37. V: reward – food
38. V: reward – physical touch
39. V: reward – personal contact
40. B: dog wants to do well

41. B: dog wants to do well

42. A: reward – verbal

43. A: reward – personal contact

44. A: treats not best for training

45. A: treats not best for training

46. A: reward – connection

47. A: reward – verbal

48. A: author's dog – no treat

49. B: dogs respond differently to training

50. B: love of a dog is beyond treats

51. B: love of a dog is beyond treats

52. B: love of a dog is beyond treats

Appendix K.

Artifact Code Book

Code	Definition	Quotes
active	more active physically	more physically active
anxiety	less feeling of being anxious	not passing on anxiety to others
		less
		reduced for test taking
		lower
		less anxious about coming school responsibilities
		less anxious
art	art skills have improved	improved
		skills better
		more details
assertiveness	willing to speak up for self, ask for something on own	scheduled a ride along
assimilation	more easily able to learn new information	new material
		faster
attitude	more positive about life	more positive
		final seems so easy
		not crying at home over school
		getting along better
		not pessimistic anymore
		doesn't hate school
auditory processing	processing sounds	better
belief in self	higher belief in themselves	sense of accompli.
		cycle is broken
		not the same kid
		has what needs to succeed
		real change
		understands intelligent
		believes in her brain
		able to be successful
		more contentment
		more courage
boundaries	ability to create boundaries for self	can create them
		can say no

Code	Definition	Quotes
caring	cared for something specific about their life	cared about quality of work
challenge	can accept a challenge as a positive opportunity	knows can handle what is next
		enjoys life again
		not being afraid of them
choices	making better choices	better
chores	responsibly taking on chores around the house	makes bed everyday
clarity	no confusion in the brain, thougth	no longer confused
		thinking more clearly
		thinking is clearer
cleanliness	cleaner in areas of their life	room
		car
commitment	more engagement in things, involvement	more committed to class
		committed to things better than before
communication	clearer, more precise communication with others	more attentive in conversation
		better ability to communicate
		can control communication
		better articulation
		can articulate thoughts
		paraphrasing during meetings
comprehension	clear understanding of material, instructions	understanding a lot with competence
		understands content
		summarizing is easier
		remembering instructions
		more details the first time
		retaining content when reading
concept comprehension	understanding information, specifically content based	explaining in class
		the one who was right in class
		absorbing info in real time
confidence	belief that a person is certain about themselves	no nausea before show
		trust gut
		"I am right"
		improved
		no more "I don't know what I am doing"
		not feeling stupid

Code	Definition	Quotes
		not feeling lost
conversations	being able to keep up with conversations with others and feel a part of the conversation flow	following them
		can find words in the moment
		shift between two conversations
		can follow phone conversations
		engaging in them
decision making	more decisive, quicker, and better decision-making process	better
		quicker when driving
		good process
		decisive
details	attention to detail	better attention to details
		better with
determination	will stick with a task, perseverance on a task or tasks	doesn't give up
		"I just do it"
		not giving up
		more perseverance
		works through the obstacles
driving	driving abilities have improved	better awareness
		not running red lights
		positive comments from driver training
		safer
		knows where to go
efficiency	productivity, being able to complete tasks with less effort	can get through a phone tree
		more efficient studying
		better
		more
effort	putting forth effort in tasks	putting in more on schoolwork
		attacking challenges with genuine effort
		brought home a book
		even reading at dinner
emotional control	able to control emotions, not having large emotional swings	calmer
		less freaking out
		can control emotions
		arguing is less emotional
		can recognize when getting frustrated

Code	Definition	Quotes
		decreased impulsive behavior
		calmer
enjoyment	finding pleasure in tasks, activities, or life	in reading
		enjoying math
		reading increased
		finding joy in music
		enjoyed writing paper
		enjoys life again
enthusiasm	excitement in life	more
		for work
excitement about tool	excited to use a tool that may have been difficult prior	phone is a big deal
fear	not feelings of being scared	no longer scared
focus	able to stay on task without distraction	better attention
		can leave room and recall
		can be interrupted and recall
		quiet mind
		not distracted by noise
		not distracted by people working next to me
		can stay focused longer than usual
follow through	able to stick with things to see them through	stuck with something
future belief	belief there will be good things in their future	excitement about what's next
		decided to get a ged
		looking forward to the day
		care more about future
		better able to see big picture
goal setting	able to set goals, willing to set goals	sets more
		setting long term
		ready to complete
grades	improved grades in school	A's and B's
		better English grades on own
		writing got a 92%
		a in physics
		highest GPA this semester
gratitude	thankful	thankful
		happy for LearningRx
happiness	experiencing joy in life	having more fun

Code	Definition	Quotes
		a lot happier
		feels happier
		smiling more
		love of learning
helping others	willing to help others on tasks	doesn't project that math is hard when helping kids
		can help kids with math
		improved teaching skills
humor	understands when others use humor in conversation, have their own sense of humor	sense of humor came back
		improved sense of humor
		quicker at trash talk
independence	able to do things without support from others	doing things more independently
		assignments done independently
		thikning for herself
initiative	initiate independently	more with school work
		created card game
		took initiative
language	use of appropriate language improved	using better language with students
		using better language with coworkers
leadership	taking on leadership positions	"a leader"
		better captain
learning	ability to learn improved	improved
		breakthrough reading music
learning new skills	can learn new skills quicker and easier	learned how to play cribbage
listening	listening for information, listening longer periods of time	better in class
		able to listen to lesson
		better ability to listen
logic	use of reason	can follow directions better
		ability to process info accurately
		can judge right container for leftovers
		better able to analyze information
		making connections
math	ability in math is improved	skills improved

Code	Definition	Quotes
		going really well
		does calculations at work for boss
		quick math skills
		more success with number problems
maturity	acting more like an adult	handles things in a more mature way
		more mature now
medication	reduction or elimination of medication	no longer on meds
memory	recall of information	times for appointments
		find car
		no more sticky notes
		recipes - don't have to refer as much
		spontaneous grocery list recall
		recalls schedule
		remembering appointments
		remembering more for longer
mental calculations	ability to calculate problems in head	math in head
		can do math in head
motivation	desire	self-motivated
multi-tasking	doing more than one thing at a time	easier
note taking	ability to take more precise, clearer and quicker notes	during meetings
		briefer
		writing better notes
		can take notes in class
observant	recognizing changes	recognized learning experiences
openness	open with feelings	open to training
organized	putting things in their place, keeping things neater and more organized	things are in place
		staring on top of stuff
		tracking everything
		cleaner room
		cleaner car
others notice	Other people notice improvements and/or attitude	family notices much more "grown up"
		husband notices differences

Code	Definition	Quotes
		husband notices happy with gains
		sister blown away
overall performace	performance improved	awesome results (on testing)
		applies what she learns
		able to do school better
overwhelmed	not feeling inundated	no longer thinking going to fail
		not drowning in homework anymore
patience	ability to accept delay or slow pace	allow mind to work
		able to handle being overwhelmed
perserverance	can stick with something for longer period of time	more consistent going to gym
		no longer thinking going to fail
		better at pushing through frustration
		less procrastination
		not dwelling on problem
positive about self	optimistic about self, less negativity	takes more pride in work
		less self-negativity
		more poise
		catching negative talk
positvity	optimistic attitude	positive thinking
		more positive attitude
		positive attitude
problem solving	solving problems on own and at higher rate	solves own
		able to tackle difficult problems
		problem solver now
processing speed	ability to process informaiton quicker	thinking quicker on feet
		noticing things
		assignments done faster
		faster counting at work
		answer quicker in class
procrastination	not putting things off	understanding this is a choice
quality of life	better quality in all aspects of life	better
quality of work	better quality in work performance	better

Code	Definition	Quotes
reading	ability in reading improved	sound out words
		doesn't skip words
		can figure out words without guessing
		needs new books
recall	recounting information	easier to recall what studies
		could recall thinkgs from history a month later
relaxation	able to rest or take part in recreation	can relax
		more at ease
responsibility	acting independently	more willing to take on responsibility
risk taking	tries new things, pursues things may not have pursued before	starting a pattern business
		went to first convention
		pursued internship
school effort	putting more effort into school tasks	taking 4 classes
		more credits
school performance	performance in school is better	A on math final
		work got better
self-advocate	able to ask for help, question	can do it now
		assertive with teacher
		will go ask about questions got wrong on homework
self-awareness	aware of own abilities, challenges	increased awareness of intelligence
		increased awareness of ability
		more aware of challenges
		in a much better place
		felt brain transformation
self-esteem	confidence in own abilities, self-respect	different person back then
		"I've got this" is more believable
		come out of shell
		feels capable at work
skills - general	general skills abilities, doesn't fit in another category	better skills
sleep	sleep	less tired
sports skills	improvement in sports abilities	playing smart
		football skills increased
		visualize plays

Code	Definition	Quotes
		predict opposing plays
strategic thinking	ability to apply strategies to thinking	less complicated strategies
		using shortest path
		using strategy on what is happening
stress	feeling less pressure mentally or emotionally	drawing less stressful
		less about school work
		less stressed at school
studying	efficient studying, feeling prepared	planning studying
		3x faster
		did not study for chemistry final and got a b
task completion	completing tasks and doing them on time	able to focus on priorities
		stay with task
		quicker finishing
		getting things done faster
test taking	taking tests is easier, more efficient, improved	ACT scores went up
		finishing quizzes
		not finishing last
time management	managing time and using it wisely	more free time
		always done on time
		can get plans done
		keeping own schedule
trust in self	trusting in own abilities	some planning ahead
		trusts his opinion
		trust memory
		trusting her mind
visual processing	ability to process visual information	mental pictures better
		noticing things around her
		navigation skills better
work performance	performance on work tasks	giving ideas to boss
		things are better at work
work quality	quality of work improved	better
writing	writing skills improved	best paper in English class
		didn't have to edit papers
		better original work
		can get words to paper better

Appendix L.

Participant Interview Code Book

Code	Definition	Quotes
achievement	accomplishments in school, work, life	during last semester I was being a TA
		it helped with every aspect of my life
		I was successful in college
		started passing tests
		really bringing my grades back up
		I was able to do some things that were dreams in my life that I've been able to accomplish and put together.
		I ended up getting accepted into one of the top PT programs in the nation
assertiveness	willing to speak up for self, ask for something on own	it's like ok why am I doing this
		now if I don't understand something when somebody's explaining it, I ask them to say it again
		I love asking questions that don't have answers yet
		I'm more upfront with, "I don't know how to do this, could you help me with it?"
		put myself in that situation to ask questions in class
		I tend to advocate for myself a lot more
attitude	more positive about life	that was cool (research)
		and I came up with one word, attitude.
		I'm motivated to keep myself active.
belief in abilities	belief abilities have improved	knowing what you're doing has a purpose behind it
		I have enough ability to be a normal person instead of secluding myself
		I don't know I would be in this place without this program
		it was so good to know that I can do it
		you just gotta power through it
belief in future	belief there will be good things in their future	I believe that I don't have any limits, in the sense of my cognitive skills
		this is something that'll help me in the future

Code	Definition	Quotes
		and then I'm thinking to go into industry right after I graduate
		I'm excited to see where it takes me
		I feel like I can do it, you know, whatever it is
		I believe I'm going to have a profession and a life that I really enjoy
		it feels very positive going to this next year
belief in self	higher belief in themselves	what I say deserves to be heard
		I feel like I'm meant to be there when I'm in a room and I'm speaking
		what I have to say has value
		I do feel like I deserve to be in that class
		I do think I see things differently
business planning	ability to plan for their business	I'm always looking for new team members, so that I don't get stuck here by myself
commitment	more engagement in things, involvement	all my teachers have done really dope things, know that they're talking about, so that's what makes me go to class
		that's what makes me work hard
communication	clearer, more precise communication with others	just articulating stuff
		I have opened up to other people
		I am able to speak more clearly about what is expected and how it's needed
		I'm also listening constantly
		if I'm engaged in a conversation with someone, and I've been there, I want to be able to ask questions about their experience
		I can talk to anybody, and I can hold a conversation with you
		trying to be more succinct
community involvement	involved in activities in the community	that's a whole other experience I'm very pleased to have had
		ladies club - It gives me a place to socialize that has nothing to do with work, but in an area of interest.
		this gives me a place with other volunteers a place to share my textile nerdishness with other textile nerdy people

Code	Definition	Quotes
confidence	belief that a person is certain about themselves	why sit here like panicking, when I really did have a lot of knowledge that I could solve for it
		I know I'm capable of it
		I'm not afraid to ask for help anymore
		my response to them is, "I designed it myself"
		I know I made the correct choice, 150%
		I was standing, holding my own
		I got both, but the confidence I had afterwards well exceeded the actual results, for sure
content comprehension	understanding information, specifically content based	I didn't even study for the final for that
		going thorugh physics, I did understand the concepts
curiosity	asking questions, finding more information	since people are still the center, I'm so curious about your name, and where it came from
decluttering	clearning out things	okay, I am always of throwing papers, or articles, or anything away
		if you notice right now, I came in this morning, my desk is clean
educational achievement	higher accomplishments in school	I had hard classes
		I ended up getting a b in my physics class
		I TA'd for a class which I got an a
emotional control	able to control emotions, not having large emotional swings	now it's like no, it's okay, everything's gonna work out
		instead of freaking out about it, I was just like, okay, I had my phone, all my other stuff was inside, the participant…..I'm not going to freak out
		it's not the end of the world
		just staying calm
		I can deal with the emotions
		I now feel more comfortable that I'm not going to lose it
enjoyment	finding pleasure in tasks, activities, or life	understand how I feel and like telling people how I feel
		it's kind of a cool experience, and I'm happy that I get to have it
		I was so happy seeing what gains I was getting

Code	Definition	Quotes
		I love school
		I actually started enjoying it
		much, much happier
		I just feel really happy with where I'm at
focus	able to stay on task without distraction	wasn't scatterbrained all the time
		I can now focus in
future plans	able to make plans for the future	owning my own business, I don't ever have to retire
		to control my own destiny almost is something that I know I can do
		putting myself out there more than just trying not to drown in this whole new universe
goal setting	able to set goals, willing to set goals	the process instead of the end goal is probably the most important thing for me
		that was definitely a goal that I reached (boyfriend)
		then I list up the steps that I need to get there
		I've become a very goal-oriented person
		so but like it's fluid, I can change the goal if necessary, so there's nothing, that's always a consideration for me is maybe the goal wasn't the right goal
		I always try to set goals for myself
		I have to set new goals because I've kind of had this plan for the last ten years and not it's kind of coming to I'm getting into the work world
handling setbacks	able to handle when things don't go the way planned	I transferred to another college the next year. Had a gpa of 3.4
		I didn't want to be at school, I couldn't play baseball anymore
		I ended up hurting myself so I couldn't play baseball anymore
helping others	willing to help others on tasks	we're here to help each other improve our lives
		and just working with other people in school
		gotten involved with a ton of different activities
independence		I live in downtown LA by myself

Code	Definition	Quotes
	able to do things without support from others	I live on my own, like I don't live in a dorm with all that right there
		I am completely independent in that way
		just that I'm responsible for myself
leadership	taking on leadership positions	in labs I take more of a leading role
		that's why I think I've taking more of a leadership role
		I'm now the president of my local club
		I have a different style of bossing, because I want to know how to do everything
logical connections	can see connections between things using reason	I could not have been a research assistant and a TA before the program because I was barely keeping up with my classes
		I can't just set this goal and then be so anxious about it that I can't achieve it
		and then I think the "why" - like why I am doing it
		I can't afford to eat out
		I need to make my own food
		I have kind of more of an algorithm of what I think is going on
memory	recall of information	I was starting to retain things on my own
		I took a little notebook with me, and I wrote some things down, just for key memory things
		when I do forget things, it's not as common
		I don't forget as much
		the ability to remember things improved
		it waxes and wanes, but in the end, it comes back
not feeling alone	not feeling that have to figure out life alone	instead of just me trying to figure out everything by myself
organization	putting things in their place, keeping things neater and more organized	in my home, things are hung up, make my bed every day
		and organized
		it's a very methodical thing, which is giving me more time to do some of the thing I love
		my year for '19 is very well organized
others notice changes		friends that I had, how I opened up to people, that wasn't there

Code	Definition	Quotes
	Other people notice improvements and/or attitude	with my family life, they know that I'm knowledgeable now
		I hug my family
		a lot of people have commented on, "you get more done that any person I know"
		they kind of, less concerned in certain ways
		they felt the need to remind me, don't forget your keys and not they don't think I'm as forgetful
ownership	takes personal responsibility of feelings or information	I feel like my knowledge is my knowledge now
		I feel like I have that knowledge
physical reaction	had a physical reaction during training or after training	got off my ADHD medication
		I would feel something inside my brain, it was like a chemical was released or something
		I'd walk into Rx, and boop, something just happened
		Then I was also having physical reactions when I was working very hard.
preparation	ability to take steps to be prepared for things that need to be done	I had to prepare myself because students were going to ask questions
		I wanted to be able to answer them (questions)
		they also need some instructions on, to see the exhibition…. explained in detail
problem solving	solving problems on own and at higher rate	taking one step at a time
		I go in straight and just attack the problem
		if I don't understand, attack another route
		I know what I need to learn and figure out
		I'm not retracing steps over and over again
		I just know where, I know how to fix, I know to make the adjustments
		I can analyze the problem
processing speed	ability to process information faster	easily think of something
		and I did that like super-fast
		it just flows easier
		because of the training, I've gotten faster at this
professionalism	acts like a professional	I had to be like professionalism

Code	Definition	Quotes
questioning the future	thinking about choices for future	I was like what do I do
		I don't know what to do with myself
realistic expectations	setting expectations within reach	there's no point in me being like, "yeah, I'm going to get an A+ on this huge paper."
		that's just an unrealistic expectation, and that's something I've learned.
reflective	deliberately taking time to think about things	and think about what's happened so far
		I know myself to the point where I know
		I know exactly that's the path I would have gone down 100%
relationship	relationships with others are better	my relationships have changed so much
		my relationships with my family has improved a lot
		my parents didn't have to worry about it anymore
		my relationship with my parents got a lot better
		I get to love them, but then I get to have these other relationships.
		my grandson is wanting to spend more time with me.
		I get along with people fine
risk taking	tries new things, pursues things may not have pursued before	I pretty much threw myself to the wolves per se
		I've done like something here now that I've kind of never really done before
		I want to get good at something
		I want to achieve a certain proficiency at something
seeing value in learning	seeing importance in learning	I want to absorb it more next semester
		at the end of the day I learned so much
		if you enjoy it, learning is not just about learning about neuroscience to get this career
self-care	taking more care of health, mental care	I can't punish myself, because I'm working, that I go at night
		I am working on my physique, as well as my mental health, my physical health
		if I don't have my health, I have nothing
		I'm usually asleep by 10:00 or 11:00

Code	Definition	Quotes
		the alarm goes off at 6:00 and I feel refreshed, and start again
		when I don't sleep well, I try not to allow myself to sleep in
		when I am tired two days later, finally, then I might allow myself to sleep in
self-control	able to control actions	that was a whole situation
		I am not a confrontational person in the slightest amount
		I don’t owe my friends or those people anything
self esteem	confidence in own abilities, self-respect	and I know that I can do it
		I feel like I'm no longer trying to prove myself to other people
		I was like, "I did it and I'm doing it"
		I'm really proud of myself
		getting into school, into my dream school was huge
		I have the ability to do
stress	feeling less pressure mentally or emotionally	just not being anxious all the time
		I didn't fully stress over the grades that much
		I wasn't so worried about getting work done
		my nerves, my anxiety have decreased
		I'm not spending all this time in the world just spinning
task completion	completing tasks and doing them on time	I'm just getting so much done
		finish things
		easier for me to finish things
things come easier	able to grasp things more easily	I don't have to pour so much work in and still get things wrong
time management	being able to manage time well, get things done on time	I was able to prioritize both school and hanging out with him (boyfriend)
		a lt of things you had to be doing simultaneously
		when I get it done, I'm always on time
		always on time
		then once I have it planned, I can just move on and go

Code	Definition	Quotes
		and if it takes only four hours, I don't know that I necessarily will force myself to use up the rest of the day
true to oneself	not giving in to what others want, but doing what they want	one of my big words is being authentic and true to myself
		what you see is what you get
		been reading this same book for 14 years, when you're ready for it, you're ready for it.
trust in self	trusting themselves to accomplish something or make a decision	just trust that it's going to happen