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A Case Study On The Effects a TBI Has On Learning

by

Jessica H. Ellis

A thesis submitted to the Department of Education and Human Development of the State University of New York College at Brockport in partial fulfillment of the requirements for the degree of Master of Secondary Adolescent Inclusive Mathematics Education

2/13/2014

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Jessica H. Ellis

2014

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Chapter 1

Introduction

Young adults are one of the highest risk groups for sustaining a Traumatic Brain Injury (TBI) (Hux, et al., 2009). Hence, some of the most frequent survivors are of school age. Upon reentry into education, survivors of TBI often display a gamut of challenges that interfere with academic performance with deficits in cognitive processes, such as executive functioning, memory, attention and concentration. Survivors may also experience social, emotional, or physical limitations that interfere with academic performance. Thus, "the magnitude and persistence of challenges faced by survivors of severe TBI necessitates establishing supportive environments and appropriate accommodations to support academic endeavors" (Hux et al., 2009, pg. 13). However, because of the variability and complexity of deficits survivors of severe TBI present, it is challenging to investigate the appropriate supports and accommodations for those reentering school (Hux et al., 2009). In fact, research on supports and accommodations used in the classroom for students with TBIs has been minimal, and mostly quantitative. Experts in the field, such as Ylvisaker, Todis and Glang have expressed the need for qualitative research "to explore the interaction of multiple factors affecting recovery and school integration experiences of students with TBI" (Hux, et al., 2009, pg. 14). This thesis provides such research in the form of a case study about a survivor of a TBI, Victoria, which is a psudonym to protect the identity of the participant.

This case study investigates the effects of a TBI on Victoria's learning and describes her experiences upon reentering education. To better understand how a TBI effected Victoria's learning, the literature review describes a TBI, the effects of a TBI, and cognitive load theory, which explains the underpinning mechanisms of learning. Also discussed are neurological effects of ADD and ADHD, issues of self-efficacy on motivation and engagement in academics, and adult learners' motivation for engagement in learning opportunities. It is important to understand the neurological effects of ADHD in order to understand the impact Victoria's TBI had on her learning experiences. Data was gathered from multiple sources and analyzed in order to provide a valid representation of the subject's learning experiences before and after the TBI. This case study not only provides knowledge to for researchers and educators, it also provides the subject the opportunity to share her voice and inspire other survivors of a TBI to be able to overcome their deficits and succeed.

Definitions

Cognitive Load Theory: cognitive load theory is concerned with techniques for managing working memory load in order to facilitate the changes in long term memory associated with schema construction and automation

Long-term Memory: A system for permanently storing, managing, and retrieving information for later use. (medicinenet.com)

Working memory: Working memory is a system for temporarily storing and managing the information required to carry out complex cognitive tasks such as learning, reasoning, and comprehension. Working memory is involved in the selection, initiation, and termination of information-processing functions such as encoding, storing, and retrieving data. (medicinenet.com)

Schema: a cognitive construct that organizes the elements of information according to the manner with which they will be dealt. (Sweller, 1994, pg. 296)

Automaticity: The processing of information without conscious control (Sweller, 1994)

Intrinsic Cognitive Load: The load caused by the internal complexity of the learning materials that is measured by the degree of interconnectedness between essential elements of information that should be considered in working memory at the same time (Kalygua, 2011, pg. 2)

Extraneous Cognitive Load: Cognitive processes that are not necessary for learning and are invoked by suboptimal instructional designs (Kalyuga, 2011, pg. 2)

Germane Cognitive Load: The effortful construction and automation of organized knowledge structures or schemas and the corresponding cognitive activities that directly contribute to learning (Sweller et al., 1998, and , Kalyuga, 2011, pg. 3)

Element: A chunk of information for particular learners and specific tasks (Kalyuga, 2011, pg. 2)

Self-efficacy: Self-efficacy refers to one's "personal judgments of one's capabilities to organize and execute courses of action to attain designated goals" (Badura, 1977a, 1997).

Chapter 2

Literature Review

Traumatic Brain Injury

A Traumatic Brain Injury (TBI) occurs when an external force causes a disruption in normal brain function. The effects from a TBI can range in severity from mild to severe affecting both brain function and behavior. The effects of a TBI may vary from person to person depending on the specifics of each individual injury. The most common cause of a traumatic brain injury is a closed head injury, in which the moving head is stopped suddenly, causing damage to the neurological components of the brain. The frontal lobes and their subcortical connections are most vulnerable to a closed head injury, thus there is usually some degree of damage to the frontal-subcorical systems in cases of TBI (McDonald et. al., 2002). Though patients present with variations of symptoms due to location and severity of the injury, TBI produces "a distinct pattern of cognitive and behavioral deficits" (Ponsford et al.,, 2008, pg. 233). The frontal lobes are considered to be at the seat of human cognition and coordinates information for "the regulation of vigilance and guidance of the most complex forms of man's goal-linked activity" (Mcdonald et al., 2002, pg. 335). Executive dysfunction is among the most common and disabling sequelae of a TBI, even in conditions classified as mild TBI (McDonald et al., 2002). Cognitive and behavioral impairments resulting from executive dysfunction have a wide range of effects and significant implications for social, vocational and academic success.

Executive Function Impairment in Adolescence: TBI and ADHD

The importance of executive functions for individuals with disabilities has become increasingly apparent for clinicians and investigators in rehabilitation and special education (Ylvisaker and DeBonis, 2000). Ylvisaker and DeBonis (2000) propose impaired executive functions to be at the core of some disability categories, including TBI and attention deficit/hyperactivity disorder (ADHD). Executive functions deal with the cognitive and social behaviors surrounding self-regulation and goal attainment. It is well accepted that executive functions regulate the mental processes that direct the formulation of goals, plans to achieve these goals, actions to achieve these goals, and the revision of these plans in response to feedback (Lezak, 1982; Luria, 1966; Ylvisaker and Debonis, 2000). The underlying cognitive processes that make up these abilities include, but are not limited to: selective and sustained attention, organization, flexibility in task shifting, impulse control, management of time and effort in academic and vocational contexts, self-awareness of strengths and weaknesses, and self-evaluation (Ylvisaker and Debonis, 2000). When confronted by a task one must be able to recognize the level of difficulty relative to ones strengths and weaknesses, and from there formulate a goal, plans to accomplish the goal, initiate goal-directed actions, evaluate actions and behaviors through-out the process, and make adjustments to the plan as needed. These are all necessary actions for success in an academic setting, and are very closely related to the construct of self-determination, which is highly recognized as an essential component for success for those with developmental disabilities (Wehmeyer & Schwartz, 1997; Ylvisaker & Devonis, 2000). Therefore, just as the degree of executive dysfunction has been found to significantly influence students with developmental disabilities, it is also a critical determinant of success for students with TBI. Unfortunately, frontal lobe damage is most common with a TBI, and therefore executive function deficits are prominent after a TBI.

Executive Functions and Communication

Executive function and language have been demonstrated to be interdependent in child development (Singer & Bashier, 1999; Ylvisaker& DeBonis, 2000). On the one hand, increases in language development are required for increases in metacognition and executive self-regulation. On the other hand, as socially and organizationally language tasks become more complex, the successful performance of them require a more developed executive system. Therefore, those that present with executive dysfunctions may have a gamut of communication deficits. Ylvisaker and DeBonis, (2000) have broken down such deficits into four overlapping categories: reduced social-interactive competence; difficulty with the organizational demands of discourse; inefficient deliberate, strategic memory and retrieval; and impaired strategic thinking. Social-interactive competence deals with executive function deficits that impact inhibition and impulse control. Observable behaviors due to such impairments are impulsive behavior and talking, aggressiveness, social lability, and irritability, all of which are often displayed by individuals with a TBI or ADHD (Ylvisaker & DeBonis, 2000). Executive dysfunction that deals with the organizational demands of discourse can be seen in expressive and receptive language deficits. Organizational impairments present themselves as scattered or incomplete thoughts in both spoken and written expressive language. Receptive impairments present themselves as an inability to comprehend lengthy and dense written or spoken passages, as well as an inability to distinguish between relevant and irrelevant information, despite comprehension of individual words or sentences (Ylnisaker & DeBonis, 2000). Successful encoding of information into memory, and effortful retrieval of information from long-term memory, depend on the limitations of working memory. "Working memory has long been associated with frontal lobe function. Thus, adolescents with executive system impairment associated with frontal lobe dysfunction may have considerable difficulty in school with strategic learning and effortful retrieval" (Ylnisaker and DeBonis, 2000, pg. 35). Such strategic memory deficits are often times seen in students with TBIs, as well as students with ADHD who present with otherwise normal intelligence (Cornoldi et al., 1999; Ylnisaker and DeBonis, 2000). Lastly, communication impairments can be seen through deficits in strategic thinking and behaviors. These are the tasks required to self-regulate, think about one's thoughts and actions, and then implement problem-solving behaviors (Ylnisaker and DeBonis,2000). The literature on both TBI and ADHD are both replete with these communication deficits due to the underpinning executive dysfunction at the core of both disabilities.

Frequency of executive system impairment in TBI and ADHD

The frontal lobes are the most vulnerable parts of the brain in a closed head injury, and injury to them is the most common cause of a TBI. Thus executive dysfunctions are the most prominent and debilitating sequale following a TBI and cause the greatest interference for academic success for students with a TBI (Ylvisaker and Feeney, 1995; Ylvisaker and DeBonis, 2000). Experts on ADHD now use frontal lobe dysfunction, thus executive function impairments, as an umbrella to explain the symptoms associated with this disability. There is strong electrophysiological, biochemical, and neuroanatomical evidence to support this paradigm shift in classifying ADHD as a disorder due to executive dysfunction (Ylvisaker and Devonis, 2000). Also, neuropsychological investigations have found that students with ADHD do not significantly differ from control students on nonexecutive cognitive tasks; however, they do show a significant difference from control students on tasks that require executive functions or metacognition (Braun, 1992; Douglas, 1988; Shue and Douglas, 1992; Ylvisaker and DeBonis, 2000). Barkley (1997) proposed reduced behavioral inhibition instead of inattention to be the main deficit of ADHD (Ylvisaker and DeBonis, 2000). This aspect of executive function thus affects other critical aspects of executive function, such as working memory and self-regulation. Therefore, executive function impairments lead to the symptoms of ADHD. Thus, intervention practices in the academic setting for both students with TBI and ADHD should be evidence based practices associated with compensating for executive function deficits.

In regard to ADHD, which is a congenital executive function disorder, there are three different developmental paths students will follow through adolescence and into adulthood (Ylvisaker and DeBonis, 2000). About 30% of individuals diagnosed with ADD or ADHD in early childhood experience developmental executive function delays and thus will essentially "grow out" of the diagnosis once the executive system has fully developed (Ylvisaker and DeBonis, 2000). Some individuals retain their impairments throughout adolescence and adulthood; however, they learn proper strategies to compensate for their deficits and become successful in school and social life. Unfortunately, some individuals retain their neurological impairments, but never develop the proper tools to overcome the obstacles they may face due to their impairments, and thus experience increasing academic and social failure. Multiple studies indicate that the students who tend to be successful are due to the support and implementation of compensatory strategies of teachers and parents who understand the impairments (Ylvisaker and DeBonis, 2000).

Cognitive Load Theory

Cognitive load theory (CLT) proposes how learning is processed in working memory, which has long been associated with the frontal lobe, so it is critical to consider CLT in TBI research. Ylvisaker and DeBonis (2000) stated, "The frontal lobes and closely associated limbic regions of the brain have long been known to be most vulnerable in closed head injury, the most common cause of TBI (pg. 35). "Working memory has long been associated with frontal lobe function. Adolescents with executive system impairment associated with frontal lobe dysfunction may have considerable difficulty in school with strategic learning and effortful retrieval" (Ylvisaker & Debonis, 2000, pg. 35). CLT describes how we learn based on the limitations of working memory, and is an essential construct to understand when working with students with TBIs. Considering CLT may aid in the implementation of proper instructional designs for successful learning to occur.

CLT proposes that learning occurs best when aligned with human cognitive architecture, and thus provides implications for instructional design based on how we learn. According to Kalyuga, (2011) human cognitive architecture is, "based on a permanent knowledge base in long-term memory (LTM) and a temporary conscious processor of information in working memory" (pg. 1). Information must be processed in working memory, often referred to as short term memory, and then transferred into long-term memory for learning to occur. The definition of learning, from a cognitive load perspective, is defined as a permanent change in long-term memory (Sweller et al., 1998; Sweller et al., 1991; Sweller & Candler, 1994). However, working memory is limited by its capacity and duration when dealing with novel information. We can only consciously process 7 plus or minus 2 elements at one time and for no longer than a few seconds in working memory (Miller, 1956). Kalyuga, 2011 stated, "If these limits are exceeded then working memory becomes overloaded, and learning is inhibited" (pg. 1). Therefore, a key component for successful learning and performance within education is the management of cognitive load as not to exceed the capacity of working memory. However, working memory capacity is unlimited when dealing with previously learned information stored as schemas of varying degree and automaticity in long-term memory. Human expertise comes from the complexity and automaticity of these schemas stored in long-term memory. The level of expertise increases as low level schemas are transformed into higher level schemas due to the integration of multiple elements that make up a task into a single element (Van Merrienboer and Sweller, 2006). Schema automaticity allows for those schemas to be processed unconsciously, thereby freeing up space in working memory for processing of new information. Schema acquisition and automation both effectively reduce the cognitive load that is induced on working memory. This is a key function of learning, because it provides human cognition the ability to circumvent the extreme limitations of working memory that are imposed on the acquisition of new information. Therefore, instructional design should enable both schemata production and automation. Hence, "cognitive load theory is concerned with techniques for managing working memory load in order to facilitate the changes in long term memory associated with schema construction and automation" (Paas et. al., 2004, pg. 2).

When considering CLT, most theorists assert that there are three types of cognitive load: intrinsic, extraneous, and germane load. *Intrinsic load* is the load imposed on working memory by the complexity of the material, relative to the level of expertise of the learner. Kalyuga, (2011) describes intrinsic load, "as the load caused by the internal complexity of the learning materials that is measured by the degree of interconnectedness between essential elements of information that should be considered in working memory at the same time" (pg. 2). This is known as the element interactivity of a task. If a learning task has high levels of element interactivity, then it will induce high levels of intrinsic cognitive load on the learner, due to the multiple elements that need to be processed in working memory simultaneously for the comprehension of the task. However, what is considered to be an element is dependent on the learner. An element is a chunk of information, which is stored as schemas in long-term memory. As knowledge is gained, the size of each chunk increases; therefore, what is considered as multiple elements to a novice would be considered as one element to an expert. What may induce a high level of intrinsic load for a novice most likely will induce a low level of intrinsic load, if any, for an expert due to varying degrees of already formed schemas. Thus, "the magnitude of intrinsic cognitive load experienced by a learner is determined by the degree of interactivity between essential elements of information relative to the level of learner expertise in the domain" (Kalyuga, 2011, pg. 2). Although traditionally intrinsic load is thought to be independent of instructional design, intrinsic load can be managed for a specific learner by modifying the learning task. This may be achieved by omitting some elements of the initial task during the acquisition stages of learning, i.e., chunking information, or by creating a simpler task (Kalyuga, 2011). The key to managing intrinsic load is selecting learning tasks that are not too complex, while at the same time still challenging enough to maintain motivation and engagement for individual students based on their levels of expertise.

Extraneous cognitive load is directly enacted on working memory by instructional design. Extraneous cognitive load is not necessary for learning, and is caused by suboptimal pedagogy, which requires the learner to devote cognitive processes to tasks that are not essential for achieving instructional goals (Paas, Renkl, and Sweller, 2004; Kalyuga, 2011). These unnecessary demands on working memory have the potential to inhibit learning if the combination of intrinsic load and extraneous load exceed the capacity of working memory. Therefore, it is essential to minimize extraneous load when intrinsic load is high in order to avoid cognitive overload.

Germane cognitive load relates to the mental activity used for the formation of schemas and the necessary cognitive processes to convert these schemas from working memory to long-term memory. According to Sweller et al. (1998), and Kalyuga, (2011), traditionally germane load was "associated with the effortful construction and automation of organized knowledge structures or schemas and the corresponding cognitive activities that directly contribute to learning" (pg. 3). These three loads are considered to be additive, and therefore it is necessary to manage the total load so as it does not exceed the capacity of working memory, or else successful learning will be hindered (Paas, Renkl, and Sweller, 2004). Thus, it is widely accepted within CLT that instruction should optimize germane and intrinsic load, the necessary loads for successful learning to occur, while at the same time reducing extraneous load. However, if extraneous cognitive load is minimized, and the total cognitive load is still beyond the capacity of working memory, then instruction should focus on balancing intrinsic and germane load by adjusting the learning goal to reduce element interactivity, while still implementing germane inducing techniques.

Research over the past few decades has used cognitive load theory to investigate instructional techniques that require students to engage in activities that enhance schema acquisition and automation, while at the same time minimizing activities that interfere with these processes. Such techniques include: reduced goal-specificity or goal-free problems, worked examples, self-talk, partially-completed problems, and the integration of disparate sources of information to eliminate the split-attention effect (Sweller, 2004). Although all of these techniques are evidence based practices proven to enhance learning, they are not universal for all learning tasks. The implementation of a specific instructional design should be based on the learning task at hand, as well as the level of expertise of the learner. "As learner expertise increases, the optimal instructional procedures alter. The types of tasks presented to novices should differ from those presented to more knowledgeable learners" (Paas, Renkl, and Sweller, pg. 7). If learning tasks are presented that induce a cognitive load that is either too high for the learner or too low for the learner, then learning will be inhibited.

Instructional Implications of CLT

Much of CLT research has focused on the learning of complex tasks. According to van Merriënboer et al., (2006) complex learning tasks have many different solutions, have real world applications, cannot be mastered in a single session, and pose a very high load on the learners cognitive system" (p. 343). Tasks that have high levels of element interactivity are complex, such as problem solving in mathematics, Considering CLT may assist in the teaching and learning of mathematics. Mathematical pedagogy should be implemented using such techniques as those mentioned above that reduce extraneous cognitive load and balance intrinsic and germane loads, within the limits of working memory. Reducing element interactivity to manageable levels, chunking information, based on learner expertise, as well as implementing germane inducing strategies has been demonstrated to enhance the acquisition, retention, and transfer of complex mathematics.

Understanding CLT is especially important in the field of mathematics education, because of an emphasis on discovery learning and authentic problem solving. Pure discovery learning, through a CLT framework, has been demonstrated to induce high levels of extraneous cognitive load. For novice learners, this type of learning most likely will cause a cognitive overload, and may hinder learning. For learners who have sustained a TBI, it is especially important to consider the cognitive load induced by discovery learning, due to deficits in working memory caused by the TBI. Moreno (2004); Paas, Renkl, and Sweller (2004) hypothesized and demonstrated that for discovery learning to be successful, guidance must be provided to the students, decreasing extraneous load, and making available more space in working memory for meaningful processing to occur. "Aiding the accumulation of usable rather than random knowledge in long term memory means that information need not be freely discovered by learners but rather be conveyed in a manner that reduces unnecessary working memory load" (Paas, Renkl, and Sweller, 2004, pg. 155). This concept is incredibly important for educators to consider when preparing instructional material in a discovery learning atmosphere, especially for a student who has sustained a TBI. Mathematics material must be presented to students in a way that makes it accessible to them. This means that material must contain the appropriate level of element interactivity in regards to each learner's level of expertise, the additional constraints imposed on working memory deficits due to TBI, as well as proper strategies for each learner to enhance schema acquisition and automaticity.

Ensuring that sufficient cognitive resources are actually used for learning requires a fully engaged learner. Unfortunately, trying to address the issues of motivation and engagement are not within the current boundaries of the CLT framework. This may be relative to TBI learning research because instructional methods that increase engagement and motivation may be especially beneficial for students with TBI. Kalyuga (2011) proposed a theoretical change to CLT that may connect motivation to the theory. Kalyuga (2011) argued that CLT should be reconstructed as a two-dimensional theory between intrinsic and extraneous loads. According to Kalyuga (2011), "the cognitive load that directly contributes to schema acquisition may fit the traditional definitions of both intrinsic and germane load equally well" (pg. 3). This would imply that these two loads are intertwined, and germane cognitive load cannot be isolated from intrinsic load. Germane load can be seen as part of intrinsic load required for learning, but not as its own separate entity. In fact, Kaluga (2011) asserts that trying to look at these two loads as separate entities becomes redundant, and actually devalues the theory and its instructional implications. Therefore, in order to maintain the validity of CLT and its instructional implications, more research should be conducted on the idea of redefining CLT as a two-dimensional theory.

Self-Efficacy: An Essential Motive to Learn

"Educators have long recognized that students' beliefs about their academic capabilities play an essential role in their motivation to achieve" (Zimmerman, 2000, pg. 82) The concept of self-efficacy is fundamental to this assertion. The term self-efficacy was derived from Bandura's work with phobic patients. Self-efficacy refers to one's "personal judgments of one's capabilities to organize and execute courses of action to attain designated goals" (Badura, 1977a, 1997, and Zimmerman, 2000, pg. 83). Prior to this work, Bandura 1986; Zimmerman 2000 based human motivation primarily on outcome expectancies. However, after treatment of phobic patients who all were able to conquer their fears in therapy, there were differences in abilities outside of therapy. Bandura acquainted these individual differences to self-efficacy differences. Within treatment, all patients developed a strong outcome expectancy, meaning that with the implication of proper techniques they could overcome their fears without any adverse consequences. However, outside of treatment differing beliefs about capability to properly implement the techniques caused differing outcomes. Therefore, Bandura proposed that self-efficacy plays a larger role than outcome expectancy in motivation because "the types of outcomes people anticipate depend largely on their judgments of how well they will be able to perform in given situations" (Bandura, 1986, pg. 392; Zimmerman, 2000).

Bandura went on to develop definitions for the level, generality, and strength of self-efficacy. The level of self-efficacy depends on the perceived difficulty of a given task, for example the difficulty of spelling words. The generality of self-efficacy pertains to the transferability of ability beliefs across a given domain, for example algebra to geometry. Perceived efficacy strength corresponds with amount of certainty one has in ability to perform a given task (Zimmerman, 2000). Therefore, self-efficacy is multidimensional and domain specific, meaning that perceived capabilities may vary within and cross subjects. It is important to understand that self-efficacy is based on "mastery criterion of performance rather than on normative or other criteria" (Zimmerman, 2000, pg. 84). It is the measure of how well one believes he or she can competently complete a task, not how well one believes he or she can complete a task compared to others. Also, because self-efficacy is assessed prior to task performance it is positioned that "self-efficacy judgments play a causal role in academic motivation" (Zimmerman, 2000, pg. 84).

When using self-efficacy to understand student motivation of engagement and learning, it is important to recognize the conceptual differences between self-efficacy and closely related constructs, such as outcome expectancies, self-concept, and perceived control, which have all been used in varying motivational theories. Outcome expectancies are defined as "the belief that a given action will lead to a given outcome" (Wiggfield and Eccles, 2000, pg. 71). For example, the action of completing a foreign language class with the outcome as the ability to communicate with others in the given language. Using this construct, the outcome, being communication skills in this example, acts as the motivator for learning. Shelly, Murphy, and Bruning (1989) conducted research on reading and writing achievement to study the impact of self-efficacy and outcome expectancies on motivation. Self-efficacy was measured by perceived capability of the participants to complete various reading and writing activities, while outcome expectances were measured based on the value the activities had on attaining various outcomes of future goals. Although the combination of outcome expectancies and self-efficacy beliefs accounted for 32% of the variance in reading achievement in their study, perceived self-efficacy accounted for most of this variance and was the sole predictor of writing achievement. These findings not only demonstrate the discriminate validity of self-efficacy measures, but reinforce Bandura's assertion that self-efficacy has a stronger impact on motivation than outcome expectancies (Zimmerman, 2000). This is crucial for student motivation and learning. Although a student may understand the importance of a specific outcome, if the student does not believe he or she has the ability to complete the necessary tasks that will lead to the desired outcome then motivation will decrease along with academic performance.

Self-efficacy can easily be confused with the closely related construct of self-concept. Self-concept is a more general description of one's overall perception of one's self which correlates to overall self-esteem. This global perception of one's self-concept; however, has not consistently been proven to relate to academic performance. Therefore, theorists have proposed a hierarchal scheme to self concept, with a global self-concept at the top of the scheme, with subcategories such as academic self-concept further down on the hierarchical ladder, and with academic domain specific self-concepts on an even lower rung (Zimmerman, 2000). The difference in a domain-specific self-concept and self-efficacy within a given domain is the generality of beliefs to the entire domain compared to the beliefs about ability given a specific task. For example, a student could have a poor self-concept as a learner of mathematics but have a high level of self-efficacy when asked to complete solving an algebraic expression with a single variable, or vice versa. Although there is a clear distinction between the two constructs, there is also a strong correlation between them. If a student has a consistently low level of self-efficacy within a given domain, such as mathematics, he or she can develop a poor self-concept as a math student, which significantly impacts motivation and learning. However, when looking at predictability of achievement outcomes of the two constructs, Pajares and Miller (1994) demonstrated that self-efficacy measures were more predictive of achievement outcomes than domain-specific self-concept (Zimmerman, 2000). Therefore, it is essential for educators to provide students with the proper tools and supports they need to give them confidence that they will be able to complete a task even if at first they struggle. There should always be a sense of a safety net, so students with low self-efficacy will at least be motivated to attempt a new skill. Without this safety net the lack of confidence in ability may induce a crippling fear of failure, blocking even the chance for learning to occur.

Not only do self-efficacy measures have discriminate validity in predicting academic outcomes, but they also have convergent validity in influencing choice of activities, level of effort, persistence, and emotional reactions, all key components of academic motivation (Zimmerman, 2000). Evidence suggests that self-efficacious students will have increased engagement in academic learning, exude more effort on tasks, will not give up as readily or have as many or as extreme adverse emotional reactions when struggling with a task or concept, as will those that do not believe in their abilities (Zimmerman, 2000).

With regard to choice of activity, students who believe they have the abilities necessary to accomplish certain tasks will try to tackle more challenging and difficult tasks, where inefficacious students have a greater tendency to avoid such challenging and difficult tasks (Zimmerman, 2000).

When looking at the effects of self-efficacy on effort, researchers have discovered that self-efficacious students tend to complete tasks at a faster rate than inefficacious students, as well as demonstrate higher levels of perseverance and mental effort when encountered with difficult tasks (Zimmerman, 2000). Therefore, educators should focus on fostering a positive sense of personal efficacy, especially for students who have suffered a TBI since they will need to put forth more effort to overcome acquired deficits.

High achieving students tend to actively engage in self-regulation activities during the learning process. These activities include: goal setting, self-monitoring, self-evaluation, and strategy use (Zimmerman, 2000). Self-efficacy beliefs have been demonstrated to affect these self-regulation activities of learning. For example, Zimmerman, Bandura & Martinez-Pons (1992) found that efficacy beliefs have a positive correlation with goal setting. And when these two constructs are used together to predict final course grades, it is found that they increase the accuracy of prediction of achievement outcome. Bouffard-Bouchard, Parent, and Larivee (1991) found that during concept learning "efficacious students were better at monitoring their working time, more persistent, less likely to reject correct hypotheses prematurely, and better at solving conceptual problems than inefficacious students of equal ability" (Zimmerman, 2000, pg. 87). Closely related to self-monitoring is self-evaluation of standards of performance. Increased beliefs in abilities has been demonstrated to be predictive of higher personal standards for proficiency and acceptable levels of performance (Zimmerman, 2000). Therefore, "the greater motivation and self-regulation of learning of self-efficacious students produces higher academic achievement according to a range of measures (Zimmerman, 2000, pg. 88).

Because self-efficacy is malleable and can change across contexts and time, it is susceptible to fluctuation due to instructional interventions. Therefore, instructors must be mindful of the classroom environment, the pedagogical practices that are implemented, and their attitudes towards students and their abilities. Techniques that have proven to facilitate improvements in perceived efficacy deal with modeling self-regulatory techniques, describing their form, providing enactive feedback regarding their impact, and proximal goal setting (Zimmerman, 2000). Student's self-efficacy beliefs have been demonstrated to play a causal role in identity development and academic participation and performance. "This empirical evidence of its role as a potent mediator of students' learning and motivation confirms the historic wisdom of educators that students' self-beliefs about academic capabilities do play an essential role in their motivation to achieve" (Zimmerman, 2000, pg. 89).

Adult Learners

Throughout adolescence, students are developing a sense of who they are, and part of this includes their academic self-concept. By the time one is an adult he or she usually has a strong identity, and understanding of strengths and weaknesses regarding academia. If one has a developed self-concept as a poor student, when facing the choice to utilize a learning opportunity, what would be the motivation to go back, and attempt something that is related to failure from past experiences? Especially after sustaining a TBI, which creates additional challenges to learning, on top of pre-existing challenges. Because Victoria went back to school as an adult after sustaining a TBI, it is important to define what an adult learner is and to look at the research pertaining to adult learning and motivation.

There are multiple theoretical frameworks that try to define adult learners; however, researchers have stumbled trying to find a specific definition of an adult learner (Gorges and Kandler, 2011). Some approaches try to distinguish adult learners from children and adolescents based on the way they learn, claiming that adult learners are supposed to be more internally motivated, self-directed, and problem-oriented (Knowles et al., 2005, Straka, 2000; Gorges and Kandler, 2011). However, such frameworks have been highly criticized and none of them have been accepted to solely explain adult learning (Gorges and Kandler, 2011). In fact, Norman (1999); Gorges and Kandler (2011) asserts that many characteristics attributed to adult learners are developed and established in adolescent learners, therefore making the distinction between the two quite difficult. Gorges and Kandler (2011) provided a definition for adult learners that is the most basic, and consistent across all theoretical frameworks for adult learners. They define adult learners as "people how have finished compulsory schooling, are in educational settings which support and demand self-directed learning, and decide about the extent and the direction of their engagement in education" (pg. 611). This definition of adult learners is an accurate and applicable definition for the relevance of this research.

According to Courtney (1992), Schmidt, 2009; Gorges and Kandler (2012) "adult's learning motivation can be viewed as a necessary prerequisite for adult learning" (pg. 610). Research on adult education has focused on expectancy-value theory of motivation to explain adults' learning motivation (Gorges & Kandler, 2012). Based on this framework, learning motivation is influenced by the expectancy outcomes, that one's actions will produce the desired outcome, and value of the task (Wigfield & Eccles, 2000) or learning opportunity. However, it is believed that adult learners' expectancies and values are a result of their previous learning experiences and learning motivation (Gorges and Kandler, 2012). These two factors are influenced by a variety of other factors; however, most important for the scope of this paper are individual beliefs pertaining to self-efficacy, attitude, and affective memories of prior educational and learning experiences.

Through an expectancy-value theory framework, affective memories are defined as sentiments related to past learning experiences, and these emotions are correlated with students' academic motivation and achievement (Gorges and Kandler, 2012). These emotions may be positive or negative thereby either encouraging or dissuading engagement in a learning opportunity. Also, affective memories influence beliefs related to ability (Gorges and Kandler, 2012). Therefore, positive emotions of past performance and competence can positively influence current beliefs about abilities and increase motivation and engagement in learning opportunities, while negative emotions can have the opposite effect on ability beliefs and possibly decrease motivation and engagement in learning tasks.

Instead of an overarching feeling of emotion related to a specific educational domain, an affective memory can also be a single event or "affect-laden episodes" (Shunk, Pintrich, and Meece, 2008; Gorges and Kandler, 2012, pg. 611) from the past that still influence present perceptions and behaviors. It is suggested that these memories are triggered by anticipation of engagement in a specific learning task , and can have positive or negative effects on motivation and engagement for adult learners (Schunk et al., 2008; Gorges and Kandler, 2012). Thus, the academic identity a student develops during previous educational experiences, and the affective memories one has will influence motivation and engagement of a learning opportunity as an adult learner.

Considering CLT, self efficacy theory, executive dysfunction due to ADHD and TBI, and how past academic experiences affect current learning experiences for adult learners, sets the stage to focus on Victoria and her TBI experience. The next chapter describes the method used for this case study, which is then followed by a chapter that describes Victoria's learning experiences pre and post TBI, as well as a chapter which acts as a podium for Victoria's message to educators of students with TBIs and her message for students who how have sustained a TBI.

Chapter 3

Method

A single case study method was implemented for this qualitative research in order to gain an in depth understanding of how the acquisition of a TBI affected Victoria's educational experiences and learning after sustaining a TBI. All measures were taken to assure the identify of the participant is not known. For this case study, data was collected through interviews conducted with the subject and her mother, field notes, observations from a neuropsychological appointment, and academic documents from Victoria's school, i.e. academic transcript and Individualized Education Program (IEP). There were five interviews with Victoria, and two of these included interviews with her mom, pseudonym Lynn. Multiple interviews with Victoria allowed the primary investigator to gain an understanding of the experiences Victoria had pre and post TBI and the effects her TBI had on her learning experiences; however, interviews with her mother were important to fill in the gaps of information Victoria was not able to remember due to her injuries. All interviews were conducted at a location of the participants' choosing, recorded with an audio recording device, and later transcribed. Open coding was used in the analysis of the interviews. All statements were considered as important; however, because the focus of this thesis is learning experiences, interview information that did not tie tightly to Victoria's learning experiences pre and post TBI, were only briefly mentioned in the results section. The triangulation of data allowed for a valid and deep understanding of Victoria's experiences; however, most of the analysis came from the transcribed interviews.

Victoria is a 31-year-old female at the time of her participation in the study, who lives in her own apartment and is completely independent. She was 24 when she sustained her TBI. She has adequate hearing, speech, and communication abilities; therefore she did not need any forms of assistance for the interviews. She speaks English as her first language, and had no physical limitations prior to her injury. However, prior to her injury she did have a pre-existing neurological disorder, ADHD. She was diagnosed with ADHD when she was in the first grade.

Chapter 4

Results

Pre-TBI Education Experience

Due to pre-existing executive function deficits, Victoria struggled with academics prior to her TBI. When Victoria was six years old and in first grade, she was diagnosed with ADHD and a learning disability. During that year, before her diagnosis and special services were implemented, she had fallen behind, and therefore repeated the first grade. From the onset of her diagnosis and all throughout her academic career, she received special education services. Victoria fully participated in the general education setting; however, she received special services through a resource room three times per week, as well as counseling once a week. Her testing modifications included extended time, directions read, simplified language on test questions, additional examples, listening passages repeated up to three times, and a calculator for math tests. Her strengths were in reading, and her accommodations were in math and written language. Victoria was a strong reader with her decoding and comprehension at grade level; however, when the content area was difficult for her, her level of comprehension decreased. Also, her processing time for information could be longer than her peers or the pace of the class. She required additional processing time beyond that of a typical student, and would often fall behind in class if she was not allotted additional processing time. Also, due to her ADHD, Victoria was highly distractible, and she had a limited concentration span. These executive function deficits made academia much more challenging for Victoria than the average student. Victoria explained it as,

> You are in a class, whatever topic it is. Crack open a book, we're on this chapter. This is what it consists of, this is what we are doing. And in order to understand this it's from

> previous chapters, and I probably just figured that out slower than everyone else did. Then I would get confused, and I'm trying to sit there and figure out how all these things are working together, and in your confusion, there goes your concentration out the window. Then your ADD kicks in, and a lot of that was I'm confused, I don't understand, the class is going to continue on and do this, and you're in the dust already and you're like 15 minutes into class.

Victoria's feelings of confusion and falling behind were often due to cognitive overload when information was presented in ways that exceeded her working memory capacity, impeding her learning. Since academic learning is additive and increases in difficulty and complexity, students are required to build on preexisting and learned knowledge and abilities as the material becomes more challenging. This requires schema acquisition and automaticity, which creates space in working memory for the processing of more complex material. By chunking information, which reduces the number of interacting elements and intrinsic load imposed on Victoria's working memory, and increasing the processing time for novice information, Victoria could develop schemas and transfer information from her working memory to her LTM. However, in situations such as the one Victoria described, information was not presented in a manner which allowed her to develop the necessary schemas needed to process the new information. Therefore, her level of expertise on a given task was lower than the average student's level of expertise. What was represented as one element of information in the average student's working memory was considered as multiple interacting elements in Victoria's working memory. Therefore, the introduction of more complex novice information induced an intrinsic load that was beyond the limits of her working memory. Thus a cognitive overload was induced, inevitably hindering learning, and causing Victoria to fall further behind.

Situations such as this led to feelings of frustration and discouragement. She felt as though she was not intelligent and was embarrassed of her learning disability. Victoria stated,

I would be the one waiting for all the kids to leave the classroom just because you were so embarrassed. Like what's wrong with me? And they'll be like well it's really easy. It's like this this and that. Like listen, I know you see a normal person here, but you don't have me at all. I don't know what you are talking about. It kind of puts you in the shadows a lot.

Therefore, Victoria developed a low self-efficacy, especially in math. Math was Victoria's weakest subject area and caused her much distress and anxiety. Because mathematics is complex, and the study of complex subjects can be challenging for students with executive function deficits, Victoria had difficulty comprehending and retaining abstract mathematical concepts, which made math courses very difficult for her. She had very low self-efficacy beliefs in her math abilities, which caused her to develop a math phobia. Her phobia stemmed from a traumatizing experience in 5th grade:

> I was in Mrs. Bush's math class. We were doing long division. She lost me right away, and I raised my hand. I asked a question. She laid me right out. I felt so stupid. I just remember that embarrassment where you feel that redness on your face. You feel all that blood flush. I was like whop that was it. I remember sitting there where I was, and her just looking at me like you idiot and total disappointment, and an utter look of disgust, and how dare you even think out loud like that and in front of everybody.

The combination of her math phobia and low self-efficacy beliefs as a math student, were almost paralyzing at times, barricading her from even attempting to achieve in her study of mathematics.

As a student with ADHD, Victoria had to develop learning strategies and coping mechanisms to overcome her executive function deficits and be successful academically. She needed information chunked and presented in a direct method. She had a visual kinesthetic for learning, therefore multiple examples and manipulatives were helpful tools to facilitate learning. Also, the use of graphic organizers helped her organize her thoughts and helped with comprehension of difficult content. All of these learning strategies were implemented in order to manage levels of intrinsic and extraneous cognitive load so as not to cause cognitive overload. She learned to advocate for herself when she did not understand information; however, often times she was embarrassed and did not advocate for herself in a timely manner. Victoria's mother was a very strong advocate for her, and made sure that she received all of the services and modifications that she was entitled to. Yet, Victoria did not graduate from high school due to family issues unrelated to academics. Victoria dropped out of high school towards the end of her senior year and did not graduate.

Victoria’s Accident

Victoria acquired her TBI from a car accident when she was 24 years old. When driving one night she had an accident and rolled her truck three times and was ejected from the vehicle. She sustained very serious injuries. She had burns all over her body from severe road rash, 14 broken ribs, two collapsed lungs, two broken orbits, a broken shoulder blade, a broken clavicle which nicked her corroded artery, a lacerated liver, five skull fractures across her forehead, and a cerebral hematoma. The trauma to her skull caused bruising and swelling of her brain as well. Initially, Victoria was responsive in the hospital's trauma center, trying to communicate by writing the alphabet on the arms and hands of those around her; however, because of the severity of her injuries she was put in a medically induced coma to allow her body and her brain time to heal. She was transferred to an Intensive Care Unit (ICU) where she spent the duration of her stay in the hospital. Victoria was in a coma for six weeks, and upon regaining consciousness was transferred to the brain injury unit where she had a remarkably short stay of only two weeks before she was allowed to return home. While in the brain injury unit, Victoria received both physical and occupational therapy, as well as speech therapy. Following her release from the hospital she continued physical therapy for a short period of time.

Due to the severity of Victoria's injuries, doctors were not able to predict Victoria's outcome nor the degree of brain damage and the effects Victoria's brain injuries would have until she came out of the coma. Her mother, Lynn, recalls, "When she came out of the coma it was the most traumatizing, cause we didn't know how she was going to come out. We didn't know if she would have brain injuries, if she would be able to speak, if she would be able to walk. They didn't know either." Upon waking, Victoria was unable to blink or speak, and she had to relearn how to walk. Lynn described, "When she was walking it was like watching a baby walk all over again, but she was charging." Mentally, Lynn described Victoria's abilities to be at the level of about an 8 or 10-year-old. She struggled with oral expression initially, and her short term memory was severely impaired. Over time, Victoria regained most of her physical and mental abilities to the same level as they were prior to her accident. However, due to frontal lobe damages she displayed more pronounced executive function deficits, most notably severe deficits in working memory, affecting her receptive language skills. Lynn described Victoria as a fighter. "She was a fighter from the day it started...she was determined and she was young. I don't know what was going through her head, but she was like I'm coming back...for how severe she was they [the doctors] were even amazed with how quickly she regained everything."

Post-TBI Education Experience

Four years after Victoria's accident, at the age of 28, she decided to go back to school and get her GED. She then continued on to pursue an associate's degree in communications at a local community college. During the time of this study, she was in her final semester of her associate's degree, and by the end of the study she had graduated from community college. The decision to return to school was difficult for Victoria, and she almost talked herself out of it. Victoria stated, "I was pretty much talking myself out of going to get my GED. I was making myself physically sick over it. I was terrified." Her fear of failure due to her previous educational experiences, combined with her added learning deficits caused by her TBI, was almost crippling. Victoria claimed that the thought of academics, especially math courses, was like "old enemies or monsters under your bed."

Academically, Victoria faced many cognitive challenges post TBI. However, One of the reasons this is a unique case study is Victoria's pre-existing executive function deficits. Because she had ADHD prior to her TBI, the transition from pre- to post-TBI learning was an annunciation of her previous experiences with executive dysfunction, not an extreme paradigm shift as a learner, which is most often seen with students with TBI. Because ADHD is considered a disorder of executive dysfunction, which is the most common sequale after sustaining a TBI, Victoria experienced similar challenges academically pre and post-TBI; however, after obtaining her TBI, her executive function deficits were much more pronounced, most significantly in her working memory limitations. When referring to her working memory, Victoria stated, "my short term memory sucks. It's not just like brain farts. My brain has constant gas." However, overall she described her deficits and challenges in her learning as the same as prior to her TBI, except everything is now amplified. She stated, "I just feel like any issue I had before, they are still there just a little more tougher. Everyone is at one pace, and you want to be at their pace, and you're just not. I have to do ten times more work just to be at the pace as everyone else." Victoria's acquired working memory impairments made reading and comprehension very difficult. She had to read information or have ideas explained to her multiple times to understand the material. Victoria claimed, "I need an example for everything all the time and shown multiple times." Though reading was one of Victoria's strengths prior to her TBI, after her TBI she described:

> Reading was difficult. Like I could read a six line paragraph, and if you asked me what it was about I have no idea. That's the short term memory showing itself. I'll read it four more times, and I could probably tell you what the middle part was about, cause it was almost the last thing I just read, cause it was probably hanging in my short term memory before it faded away somewhere.

When comparing her post TBI comprehension ability to that of her prior, Victoria explained, "Before [the accident] I could read it once myself and then have someone else read it to me. That was a testing mod I had. I would have stuff read to me. I would read it once and someone read it out loud. Then I got it. After, I had to read it several times." Also, prior to her TBI, she would use strategies to chunk information found in text; however, post TBI essential information from dense text must be extracted and presented in a concise manner to make material accessible. "I need bullets. Anything concise. They'll [teachers] be like go read this chapter, and I'm like nope, I'm going to get the PowerPoint and the outline, and I'm gonna have the facts in front of me, cause my brain works like this." Prior to Victoria's TBI, she would have attempted to gather information from a textbook; however, currently her working memory deficits make such a task almost impossible. "It's instant overwhelming [reading a text book]. It's not even lazy, I can almost feel the wheels start smoking in the brain. I'm not going to obtain anything. Nothing is going to sink in for me reading it. There's charts over here and pie graphs over there. It just makes me sick. I cannot retain all of this."

Such strategic learning and receptive language deficits are common in executive dysfunction following a TBI. Although they existed prior to Victoria's TBI, her acquired executive function deficits severely limited the number of interacting elements Victoria was able to process at once in her working memory and significantly decreased the retention time novice information can be stored in her working memory. Therefore, a key component for successful learning and performance for Victoria after sustaining her TBI was the management of cognitive load as not to exceed the capacity of her severely impaired working memory. Though modifications to learning goals were necessary for learning to occur prior to Victoria's injury, more extensive modifications of the learning task were necessary to facilitate learning after Victoria's TBI. Therefore, even though Victoria's learning strategies, modifications, and adaptations were similar pre and post-TBI, post-TBI she needed to approach learning more directly, in smaller chunks, and with more patience since learning took more time and effort after acquiring her TBI.

Contrary to Victoria's experience, most often students who have sustained a severe TBI will have executive function deficits that did not exist before, and their previous abilities may not reflect their current abilities. Therefore, it is essential for them to understand their new learning limitations and new forms of tools and instruction to make learning assessable. However, Victoria's previous experiences as a student with ADHD provided her with the knowledge base of how to approach learning as a student with executive function deficits and implement the appropriate compensatory strategies to generate learning. She reflected on her previous learning experiences,

> I guess it's a blessing in disguise then [previously having ADHD], cause I know how to deal with it, cause it was already there compared to someone who had not struggled like this before and then had a brain injury. Everything is still there just enhanced...It's like this is more I know how to confine things for myself after all these years.

Although Victoria's previous learning experiences provided her with knowledge and strategies to persevere and overcome the obstacles she faced academically, due to the hidden nature of a brain injury, it was imperative that Victoria constantly advocated for herself, and build a support system around her to support her in her academic endeavors.

> Because of everything I have already been through with high school and now the brain injury, I feel like off the bat if you are in any field of education I have to tell you off the bat what is wrong with me, because I'm afraid of getting shoved into the back of the room and getting judged too. Cause I'm like I know you see a normal person, but I'm actually really slow.

Victoria became her strongest advocate, always asking for help when she was floundering. However, due to her previous academic experiences, and the added challenges Victoria faced due to her TBI, she did not believe in herself and her capabilities. Because self-efficacy judgments play a causal role in academic motivation, and Victoria had developed an identity as an inefficacious student, especially as a mathematics student, it was extremely important for her to build a safety net of supports around her. This safety net included her friends, family members, tutors, some professors, and her neuropsychologist. They provided her with positive reinforcement that allowed her to believe in her abilities as a student, which allowed her to stay motivated and persevere through her deficits to be successful. With regard to academic support, Victoria stated,

> I need that, the safety nets, the positive reinforcers. Everything like that, cause I get so bummed out on myself and my disabilities and get in a funck. Cause when you have so much struggle, you don't think you are good at anything. I don't believe in myself, so when I have a little cheerleader on my side, I'm like yeah I can keep doing this. In life I'm fine, but education I need these safety nets to get me through.

The strong support system Victoria built around her provided her with the strength to persevere and overcome the multitude of challenges she faced as a student with severe executive function deficits. Victoria's awareness of her strengths and weaknesses, the ability to advocate for herself, making others aware of her limitations and needs, and her determination to overcome her disabilities were paramount to making learning accessible and being successful as a student with a TBI.

Victoria's educational experiences, and the extent to which her TBI affected her learning are unique due to her preexisting executive function deficits she had prior to sustaining a TBI. However, her experiences support the current knowledge of the effects executive dysfunction can have on the learning, and her story has far reaching benefits for educators of students with a TBI, as well as students with a TBI. .

Chapter 5

Conclusion

Students with a TBI may present with a gamut of challenges affecting their academics upon reentry into education. They may have executive function deficits that did not exist before, and their previous abilities may not reflect their current abilities. Not only are there most likely deficits to memory, processing speed, and working memory, affecting learning, but the struggles to let go of "old self" and accept "new self," which will require the understanding of new learning limitations and new forms of tools and instruction to make learning assessable. Hux et al., (2009) stated:

> Severe TBI results in persistent and extensive challenges impacting the academic performance and success of survivors...Because students with TBI have acquired rather than developmental challenges, they must contend with pre-/post-injury differences in self-perception, learning styles, and learning abilities" (pg. 14).

These differences in abilities can be challenging for students themselves to understand, as well as for educators. Rapid reacquisition of previously learned knowledge may lead to inaccurate expectations for the acquisition of new knowledge, due to acquired executive function deficits that affect working memory, while leaving long-term memory intact. Also, due to the hidden nature of a brain injury, unless the injury and the associated challenges are told to others, there may be inaccurate expectations of abilities imposed by an educator on a student. Therefore, recognizing ones learning strengths and weaknesses, and making them aware to others is of great importance for students who have sustained a TBI. The successful completion of academic endeavors for students who have sustained a TBI requires determination and perseverance on behalf of the learner, as well as extensive support from education specialists who understand

CLT and the vast dimensions of executive functioning, and using this knowledge to implement appropriate pedagogical practices as not to cause cognitive overload. It is essential for educators to provide students who have sustained a TBI with the necessary tools they will need to compensate for newly acquired deficits, as well as reassurance that they still possess the abilities to be successful in a challenging academic environment.

A Message From Victoria to Educators of TBI Survivors

Although working with students with a TBI may be challenging, it the responsibility of all educators to make sure the needs of every student are met. This will require patients and encouragement, especially when working with students with a TBI. Students who have sustained a TBI need all the support they can get, and for teachers to believe in these students' abilities. According to Victoria,

> I think one of the most awful things is I had a teacher who felt like I was a burden and I don't know how to deal with you kind of thing. Well, ya know, I'm another human being and when you see that kind of doubt come over them it feels like they gave up on you in the beginning. Like I have potential, but I just have another way of going about it. Don't be a jerk about it. Don't sigh. For God sake don't roll your eyes when I can see it.

Survivors of a TBI are capable of academic success. Although it will be challenging and more work for educators working with students with a TBI, through patience, kindness, and knowledge of the needs of these students, educators will be able to provide them with the proper tools they will need to achieve their full academic potential.

A Message From Victoria to Other TBI Survivors

Victoria's story is one of courage, strength, and determination to overcome adversity. Her accomplishments and strive to continue to obtain her goals, despite the challenges she incurs due to her TBI is an inspiration. Part of the reason she agreed to be a part of this study was to demonstrate to others who have sustained a TBI, that they are still capable individuals who have the ability to pursue their goals and dreams. Victoria stated:

> It will not be easy, but do not talk yourself out of it...if you say I can't do this because I have a TBI, no actually you can. If I continued with that attitude I wouldn't be here. I wouldn't be in school, and because of school it has gotten me everything I am doing; anything I soulfully have ever dreamed of since I was a teenager. Because I faced my fear, I now got a job at a radio station and where we book and mange bands, and I love it. I orchestrated a show and people are watching these bands perform, because I did this. That was huge for someone who was like in a depression, cause I knew what I wanted to do but I was afraid I wouldn't be able to do it, because of my preexisting learning disabilities and then my head injury. And now it's like if I had sat that out, I would never had had that experience, and it felt so awesome. Don't be your TBI. Don't because you have a label let that define you. Don't be your problem. That's just a part of you, not all of who you are. Don't let it control you. I could have just spent my whole life going well I have ADD, and my life sucks, and I'm never going to learn anything. Always advocate for yourself, and let people know your strengths and weaknesses. There are people out there who can help you succeed, you have to find them. There are loop holes, you have to go scout them out, and then from that day forward scout them out everywhere you go.

Victoria's story demonstrates that after sustaining a TBI, the path to success may be more difficult, but do not let that prevent you from achieving your goals, because with determination and perseverance you can be successful.

References

Bullinger, M. (2002). Quality of Life in Patients With Traumatic Brain Injury-Basic Issues, Assessment and Recommendations. *Restorative Neurology and Neuroscience,* 20, 111–124.

Gorges, J. and Kandler, C. (2012). Adults' learning motivation: Expectancy of Success, Value, and the Role of Affective Memories. *Learning and Individual differences*, 22, 610-617.

Hux, K., Bush, E., Zickefoose, S., Holmberg, M., Henderson, A. and Simanek, G. (2010). Exploring the Study Skills and Accommodations Used by College Student Survivors of Traumatic Brain Injury. *Brain Injury*, 24, 13-26

Kalyuga, S. (2011). Cognitive Load Theory: How many Types of Load Does it Really Need? *Educational Psychological Review*, 23, 1-19.

Kasahara, M. (2011). Traumatic Brain Injury Alters the Functional Brain Network Mediating Working Memory. *Brain Injury*, 25, 1170-1187.

Levin, H. and Hanten, G (2005). Executive Functions After Traumatic Brain Injury in Children. *Pediatric Neurology*, 33, 79-93.

Liem, A. F., Lau, S. and Nie, Y. (2007). The Role of Self-Efficacy, Task Value, and Achievement Goals in Predicting Learning Strategies, Task Disengagement, Peer relationship, and Achievement Outcome. *Contemporary Educational Psychology*, 33, 486-512.

McDonald, B., Flashman, L. and Saykin, A. (2002). Executive Dysfunction Following Traumatic Brain Injury: Neural Substrates and Treatment Strategies. *NeuroRehabilitation*, 17, 333–344.

Miller, G. A. (1956). The magical number seven, plus or minus two: some limits on our capacity for processing information. *Psychological Review*, 63, 81-97.

Paas, F., Renkl, A. and Sweller, J. (2004). Cognitive Load Theory: Instructional Implications of the Interaction Between Information Structures and Cognitive Architecture. *Instructional Science*, 32, 1-8.

Pajares, F., Kranzler, J. (1995). Self-Efficacy Beliefs and General Mental Ability in Mathematical Problem-Solving**.** *Contemporary Educational Psychology*, 20, 426-443.

Ponsford, J., Draper, K. and Schönberger, M. (2008). Functional Outcome 10 Years After Traumatic Brain Injury: Its Relationship With Demographic, Injury Severity, and Cognitive and Emotional Status. *Journal of the International Neuropsychological Society, 24, 233-242.*

Sayeski, L., K., Paulsen, J., K. (2010). Mathematics Reform Curricula and Special Education: Identifying Intersections and Implications for Practice. *Intervention in School and Clinic*, 46, 13-21.

Sweller, J., & Chandler, P. (1991). Evidence for cognitive load theory. *Cognition & Instruction, 8*(4), 351.

Sweller, J. (1994). Cognitive Load Theory, Learning Difficulty, and Instructional Design. *Learning and Instruction*, 4, 295-312.

Sweller, J., Van Merrienboer, J. J. G., & Paas, F. G. W. C. (1998). Cognitive architecture and instructional design. *Educational Psychology Review,* 10 (3), 251-296.

Tellis, W. (1997). Application of a Case Study Methodology. *The Qualitative Report*, 3, 1-17.
Watson, A. (2010). Shifts of Mathematical Thinking in Adolescence. *Research in Mathematics Education,* 12, 133-148.

Wigfield, A., Eccles, J. S. (2000). Expectancy–Value Theory of Achievement Motivation. *Contemporary Educational Psychology*, 25, 68-81.

Van Merrienboer J.J.G., Kester, L., Paas, F. (2006). Teaching Complex Rather Than Simple Tasks: Balancing Intrinsic and Germane Load to Enhance Transfer of Learning. *Applied Cognitive Psychology*, 20, 343-352

Van Merrienboer, J.J.G. and Sweller, J. (2005). Cognitive Load Theory and Complex Learning: Recent Developments and Future Directions. *Educational Psychology Review*, 17, 147-174.

Zimmerman, B., J. (2000). Self-Efficacy: An Essential Motive to Learn. *Contemporary Educational Psychology*, 25, 82-91.